Imperial Bureau of Plant Genetics

(For Crops other than Herbage)

Plant Breeding Abstracts

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Note.—Initialled abstracts are written by the following :

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* General studies, see also individual crops.

Plant Breeding Abstracts.
Vol. IV, No. IV.

Part I. British Empire

STATISTICS 519

829. MAHALANOBIS, P. C. 519.25
Statistical notes for agricultural workers. No. 14. The use of random sampling numbers in agricultural experiments.
Ind. J. Agric. Sci. 1933: 3: 1108–15.

In response to enquiries regarding the most convenient method of collecting random samples or randomizing the lay-out of plots in field trials the author draws attention to Tippett's series of random numbers (Tracts for Computers No. XV, 1927, Cambridge University Press), giving an extract of 2000 random four-figure numbers from this publication. He goes on to give a number of illustrations of the use of this table in field experimental work. J. W.

CYTOLOGY 576.3

830. 576.312.3
KOSHY, T. K. 576.353
Chromosome studies in *Allium*. I. The somatic chromosomes.
J.R. Micr. Soc. 1933: 53: 299–318.

A description of detailed observations on all stages of the mitotic division based on the study of a number of different species of *Allium* is presented. From these observations the author concludes that the chromosome consists of two twisted chromonemata at all stages throughout the mitotic cycle, the spiral being invariably reversed in direction at the point of the attachment constriction. In consequence of this reversal, separation of the two chromonemata is brought about simply by unwinding of the chromosome from each end at metaphase, the attachment constriction remaining stationary.

Cleavage, which begins at late prophase, takes a spiral course along the thread and proceeds as the daughter chromosomes unwind at metaphase. The spiral course of the cleavage increases the number of twists in the daughter chromosomes. This spiral course is thought to be the result of the spiral arrangement of the particles composing the thread.

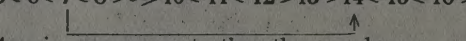
In the light of these observations and conclusions the various theories of mitosis are examined. The author considers the alv li and chromomeres reported by so many observers to be only optical illusions, the failure of the microscope to resolve the double spiral resulting in the appearance of dark and light granules. In support of this view photographs of wire models of such double spirals taken under the microscope and with variations in focussing are printed beside microphotographs of actual chromosomes.

The bearing of these observations on Darlington's theory of meiosis is briefly discussed and his assertion that the early prophase split is suppressed in meiosis called in question.

831. WANSCHER, J. H. 576.312.35
The basic chromosome number of the higher plants.
New Phytol. 1934: 33: 101–26.

The origin of chromosome numbers and the determination of their natural evolutionary sequence are analysed by a statistical examination of the chromosome numbers of 2,563 species from 38 families of the Dicotyledons and 674 species from 6 families of the Monocotyledons. Four evolutionary series of chromosome numbers were revealed namely (*a*) the uniform series, for instance, 7–7–7–7; (*b*) the multiple series, 7–14–21, etc.; (*c*) the descending series, 8–7–6–5; (*d*) the ascending series, 8–9–10, and a curve is shewn indicating the course of series (*c*) and (*d*)

and shewing that they start at numbers representing multiples of four. The situation may be represented as follows, the arrows shewing the direction of evolution :



The members of the 4 series are proper to the other numbers.
A more detailed examination of the basic number in 44 angiosperm families (including the *Cruciferae*, *Solanaceae*, *Leguminosae* and *Malvaceae*) disclosed in 37 of them either definite evidence of or some indication of a 4 system. In 5 families the basic number is traced to the number 7 which may probably be regarded as derived from 8.
Recent relevant literature is cited in an extensive bibliography.

BOTANY 58

832. ANDERSON, E. 58:576.16
Origin of the angiosperms.
Nature 1934 : **133** : p. 462.
A theory parallel to that put forward by Darlington, Moffett and Sax on the reticulate origin of the Pomoideae from a cross or crosses between other members of the *Rosaceae* is now advanced by the author to explain the origin of the *Magnoliales*.
In conclusion the question is raised as to the possible origin of angiosperms, in part at least, from crosses between some of the simpler members of the seven chromosomed and twelve chromosomed gymnosperms. An examination of the morphological evidence from this standpoint would be of interest.

833. 581.143.26.03
Vernalisation.
J. Inst. Brew. Lond. 1934 : **40** 57–58.
In reviewing the article on vernalization previouly cited (see " Plant Breeding Abstracts," Vol. IV, Abst. 359), the dormant seed treatment of Tallarico in Italy is described.

834. BASUDEV ROY. 581.32:633.3
Studies in the development of the female gametophyte in some leguminous crop plants of India.
Ind. J. Agric. Sci. 1933 : **3** : 1098–1107.
The material chosen for this investigation of the female gametophyte was *Pachyrhizus angulatus* Rich., *Cajanus indicus* Spreng., *Dolichos Lablab* Linn., *Pisum sativum* Linn., and *Lathyrus sativus* Linn.
Evidence was found that is regarded as shewing that sterility of the ovules is rare under natural conditions.
Chromosome numbers were estimated from the meiotic divisions of the microspore mother cells. The haploid number in *Pisum* and *Lathyrus* was 7 and in *Cajanus* and *Pachyrhizus* 11.

FIELD TESTS 631.421

835. GARNER, F. H., GRANTHAM, J. and SANDERS, H. G. 631.421:519.24:635.651
The value of covariance in analyzing field experimental data.
J. Agric. Sci. 1934 : **24** : 250–59.
In the results of field experiments attention is usually concentrated on the end figures of yield, these being the subject of statistical analysis. It is probable, however, that much could be done with earlier records, such as the number of plants that germinated, tillering counts and so on. In this study the technique of analysis of covariance is used with much effect to correct experimental figures at any stage in the growth of the plant, in this case beans, for variations in factors previously observed and a stage to stage analysis is made possible which is effective

in shewing the way in which two sorts of beans, each having two kinds of seed, vary in relative order at different times in the growing season. The study is of importance as shewing what is possible with the new technique in general. J. W.

836. Brady, J. 631.421:633.13–2.183–1.521.6
Some factors influencing lodging in cereals.
J. Agric. Sci. 1934: **24**: 209–32.
Apart from its interest to the plant breeder as an investigation of the lodging-resistant qualities of certain varieties of oats experimented with by the author, this paper is interesting because of the statistical nature of the experiment and conclusions. A Latin square experiment was set out to test three varieties at three spacing intervals, in all combinations, and a number of observable characteristics were examined statistically by means of the analysis of variance procedure. Further, one character, namely thickness of sclerenchyma in cell wall, was examined after allowance had been made for possible variations in the other factors, length and diameter of the critical fifth internode, these factors being subject to variation owing to external factors. The method was to use the analysis of covariance technique, correcting the cell wall thickness for the joint variation of the two other factors. A careful explanation of the statistical procedure is given. However, it is concluded that even with this refinement the cell wall measurement is too unstable a character to be of any use as an absolute criterion of the lodging-resistant ability of a variety, though the resistant variety used in the experiment had the above mentioned characters associated with strength of straw to a significantly greater degree than the medium and non-resistant varieties. J. W.

837. Murray, R. K. S. 631.421:633.912
The value of a uniformity trial in field experimentation with rubber.
J. Agric. Sci. 1934: **24**: 177–84.
The possible increase in precision in a field experiment brought about by the inclusion of yield results from the same plots in a preliminary year or years is investigated for the rubber crop by examining the data of 1000 seedling rubber trees, planted in 1911, for the years 1926 to 1929. A plot of 25 trees was selected as unit complete with barrier rows, and a 5 x 5 Latin square was superimposed on the plots. It was found by calculating the regression of the yield in the trial year on that of the preliminary year that a very great increase in precision was brought about, the experiment being between three and four times as accurate as when preliminary yields were not taken into account. The best results were obtained by considering the yields of 1927 in relation to those of 1926. The increase in precision for later years, still using 1926 as a base, was not so great. This method was found to be even more effective than the customary method of allowing for variations in fertility by eliminating row and column variation. J. W.

FUNGI 632

838. Das Gupta, S. N. 632.42:576.16
Studies in the genera *Cytosporina*, *Phomopsis* and *Diaporthe*. VI. On the conversion of one strain of *Diaporthe perniciosa* into another.
Philos. Trans. R. Soc. Lond. 1934: (Ser. B) **223**: 121–61.
The various cases in which a DHc culture of *D. perniciosa* may develop into a DHf culture are described and various possible explanations of this conversion phenomenon are considered.

839. 632.44:576.16:575.24
Henry, A. W. 633.52–2.44:576.16
Observations on the variability of *Polyspora lini* Lafferty.
Canad. J. Res. 1934: **10**: 409–13.
Cultural differences in pigmentation and growth characters were found in different strains. The origin of various saltants and new strains and their behaviour in artificial cultures are mentioned. Preliminary tests tend to shew that strains may also differ in pathogeneity.

840. 633:575(94.6)
BEVIN, R. H. 635.521.1(94.6)
Development of superior seed lines.
Tasmanian J. Agric. 1934: **5**: (N.S.) 8–12.
The selection methods used for the development of good seed lines of potatoes, cereals and pasture plants are described.
Experiments on the improvement of the yield from grey and blue peas by selection are being begun.

841. BADAMI, V. K. 633:575:537.531
X-ray as a new force in plant-breeding.
Poona Agric. Coll. Mag. 1934: **25**: 139–43.
An outline of the tasks and pitfalls confronting the plant breeder is followed by some general remarks on selection and hybridization and genetics. The predominantly negative or "destructive" mode of action of X-rays is mentioned and it is suggested that in the future a technique of irradiation may be discovered whereby instead of eliminating characters, various combinations may be effected by applying X-ray treatment at a particular phase of gametic or zygotic development. The potential value of X-rays in the induction of bud variations in sugarcane is touched upon.

842. 633:576.16
HECTOR, J. M. 581.9:633
The origin of certain of our cultivated plants.
S. Afr. J. Sci. 1933: **30**: 46–61.
A survey is given of the recent views on the origin of cultivated plants based on the published literature, with special reference to that emanating from Russia. The position with regard to cotton, maize, potato, and wheat, these being the plants of greatest importance for South Africa, is outlined.
In discussing the factors responsible for the present distribution of cultivated plants, the author emphasizes the importance of climatic changes in influencing the migrations of both plants and man, and the view is expressed that these two have operated side by side in driving the main plant resources into mountain zones, probably during the unstable conditions of the quaternary.

843. MEHTA, K. C. 633.1–2.452:576.16
Rusts of wheat and barley in India. A study of their annual recurrence, life-histories and physiologic forms.
Ind. J. Agric. Sci. 1933: **3**: 939–62.
An account of the progress since 1930 of investigations on the incidence, dissemination and physiological forms of *Puccinia* found on wheat and barley in India. The life histories of brown and black rusts are under investigation. Evidence is advanced as shewing that the number of physiological forms of the rusts being studied should not be large in India. The results of some cross inoculations with rusts of wheat and barley are mentioned.

WHEAT 633.11

844. 633.11C.518
C.518 wheat.
Leafl. Dept. Agric. Punjab No. **6**: Pp. 1.
This new hybrid wheat which has been produced by the Punjab Agricultural Department is recommended as the best variety for good farming conditions in the Punjab.
C.518 is a fully bearded, amber grained wheat with white compact, densely felted ears and greyish black awns. The straw is relatively short and so stiff that lodging is practically excluded. Its milling and baking qualities are similar to those of 8–A. Its early habit of growth is more or less erect.
In four years' trials the yields have been good, and in one instance a record yield for India of 49½ maunds per acre was obtained. Seed is available for distribution.

845. 633.11:575(94.2)

Wheat Crosses at Roseworthy College.

J. Dept. Agric. S. Aust. 1934 : 37 : 693–94.

The main objectives in the breeding work at Roseworthy College are in order of importance, improvement of the baking quality of commercial Australian wheats, production of short, strong straw, and improved holding capacity in varieties which shew a tendency to shatter, increased size and fullness of head with no sterile spikelets, and finally drought resistance. A list of the wheat crosses made in September, 1933, is given and their aims indicated.

846. 633.11:575(94.2)
633:575(94.2)

Report of the Waite Agricultural Research Institute, Glen Osmond, South Australia, 1925-1932.

Adelaide, 1934 : Pp. 149.

The most important of the plant breeding projects carried out at the Waite Institute has been first the production of improved varieties of wheat of high yielding capacity and secondly the association of high yield with high milling and baking quality and disease resistance. The results obtained by the three methods of plant introduction, selection within varieties and hybridization followed by selection are briefly summarized.

From the best of the selections within varieties a yield of 44·8 bushels per acre as compared with 39·8 bushels per acre for the standard variety was obtained in 1932.

The development of new cross-bred varieties is now reaching the stage when sufficient seed is available for field tests and four selected strains of the hybrid Gluyas x Minister have given yields varying from 42·36 up to 46·20 bushels per acre. The most promising strains will ultimately be grown at several centres throughout South Australia to determine their adaptability to the different districts.

Hope, and other disease resistant varieties have been extensively used in cross-breeding with Australian varieties with the object of developing prolific disease resistant forms.

The milling and baking quality of a number of hybrid strains has been ascertained and their yield as compared with local varieties will be determined when seed is available.

Early maturing varieties are the chief aim in pea breeding and 64th generation selections from crosses between the early Brunswick White and the best of the varieties from other states and countries are at present under test.

An attempt to breed tomatoes resistant to spotted wilt by crossing the partly resistant *Lycopersicum pimpinellifolium* with commercial varieties has been so far unsuccessful owing to the complicated inheritance of the commercial fruit type and resistance.

Exceptional hybrid vigour in the F_1 from Early Dwarf Red x Break O'Day resulted in an increased yield of 38 per cent more than that of the Standard Dwarf Red ; also the hybrids were tall and produced large smooth fruit of excellent quality. The commercial utilization of hybrid vigour is recommended.

Brief mention is made of the work on the inheritance of quantitative characters in wheat, the occurrence of off-type plants, the cytology of rye and wheat x rye hybrids and the classification of South Australian wheat varieties—much of which has already been reviewed in " Plant Breeding Abstracts."

847. Thompson, W. P. 633.11:575.127.2:576.312.35

The causes of the cytological results obtained in species crosses in wheat.

Canad. J. Res. 1934 : 10 : 190–98.

The problem here examined in the light of the findings of various workers and certain unpublished results is the possible cause of the relatively few plants shewing various recombinations of characters of the two parents in a *vulgare* (42-chromosome) x emmer (28-chromosome) wheat cross. Underlying these genetic results a similar situation is found in the chromosome numbers of the progeny of such a cross ; for most of the F_2 plants have one or other of the parental complements or some number approaching thereto, while plants with intermediate chromosome

numbers are very rare. As regards pairing also, two groups of plants have been observed (*a*) those with 14 pairs capable of pairing, plus from 0–7 univalents and (*b*) those with more than 14 pairs, plus some number of single chromosomes which makes the total of paired and unpaired elements 21 (*i.e.*, the number in the *vulgare* parent). Group (*a*) tends in later generations to revert to the condition with 14 pairs only and group (*b*) to the 21 pair condition.
The actual effect of pre-gametic causes is stated to be slight. Pollen grains with numbers intermediate between 14 and 21 are somewhat deficient in number though more frequent amongst pollen grains displaying retarded growth.
As regards gametic causes involved, it was shewn that a large number of pollen grains with intermediate numbers failed to function and similar results were obtained for the female gametes though the number that functioned with intermediate numbers was higher.
The relative importance of pollen abortion, retarded development, low germination and gametic competition and selective fertilization as factors preventing the male gamete from producing progeny is discussed. Abortion of female gametes was found to be of importance in reducing the number of zygotes with intermediate chromosome numbers. Endosperm abortion owing to marked chromosome unbalance is held to be an important factor in zygotic elimination and might be all the more far reaching in its results owing to its possible effect on the embryo independently of the endosperm. About half the embryos abort before the seed is ripe and at least half of the F_2 seeds usually fail to germinate.

848. 633.11–2.452:575.11.061.6:576.16

JOHNSON, T., NEWTON, M. and BROWN, A. M.
Further studies of the inheritance of spore colour and pathogenicity in crosses between physiologic forms of *Puccinia graminis tritici*.
Sci. Agric. 1934 : **14** : 360–73.

The previous work which has been continued in the present investigations is summarized, and the results of several progeny studies of a number of hybrid forms of *Puccinia graminis tritici* in the F_2 and F_3 generations are recorded.
On selfing an F_1 hybrid form segregation and recombination of the factors for pathogeneity gave several different physiological forms in the F_2 among which the original parent forms were often found. The number of physiological forms in the F_2 is greater in some crosses than in others, indicating that the same number of factors is not involved in all crosses.
Though the inheritance of pathogeneity would appear to be Mendelian in some respects, the persistence in the F_2 and F_3 progeny of differences observed in this character in reciprocal F_1 crosses confirms the views on extra-nuclear action in the first series of experiments (Cf. " Plant Breeding Abstracts," Vol. III, Abst. 1 and Vol. I, Abst. 107).
Evidence was again obtained indicating that different cultures of the same physiologica formsl may be genotypically different (Cf. " Plant Breeding Abstracts," Vol. III, Abst. 1).
Urediospore colour appears to have a Mendelian basis.

849. 633.11.0014(94.5)
633.11:575(94.5)

Mallee wheat tests. Results at Walpeup.
J. Dept. Agric. 1934 : **32** : 60–62.

In the wheat variety trials at Mallee Research Station, two new crossbreds, Ranee x Gallipoli and Improved Gluyas x Ranee outyielded the standard varieties, the former giving the highest yield for early, midseason and late sowing. Both are early maturing wheats. Of the other early maturing wheats Ranee 4H and Rajah did best.
The average results of eight years trials shew that the standard Mallee wheats Sepoy, Ghurka, Ranee 4H and Free Gallipoli have given slightly better yields than the other competing varieties.
In a further test with promising new crosses and leading wheats from other states, Bencubbin from Western Australia stood first with 24·9 bushels per acre, being slightly ahead of Free Gallipoli with 24·4 bushels per acre. Ranee 4H the new selection of Ranee, outyielded the old strain by 1·3 bushels per acre.

MAIZE 633.15

850. 633.15:581.9(51)

Maize in China.

Nature 1934 : **133** : p. 420.

Literary evidence is cited to shew that within 80 years of the discovery of America maize had reached China and that it was cultivated there before 1573. It is suggested that it was introduced, not by the Portuguese through Goa, but by the Arabs via Spain, Mecca and Central Asia. Tobacco was apparently not planted in China until the third decade of the seventeenth century.

BARLEY 633.16

851. BEAVEN, E. S. 633.16:575

The culture of barley for brewing.

J. Inst. Brew. Lond. 1934 : **40** : 188–203.

An historical introduction dealing with various wild and cultivated barley forms of ancient and more recent times is followed by an analysis of the external and internal factors affecting productivity and malting quality and of the author's early breeding experiments.

The general principles of artificial hybridization and its results, and of the later stage of trial and multiplication and chequer board cultures are exemplified by the actual data from various crosses made at Warminster. The difficulties of selecting plants in F_2 and cultures seeded from these plants is emphasized and a description of the author's own technique is to be published later. It should be possible, it is claimed, to shorten the testing period for barleys by taking into account the marked racial differences described in the behaviour of spring-sown barley at the two critical periods, the seedling stage and the grain forming stage in which a high or low migration coefficient of reserve food materials—an inherited character of certain races —may be of importance to the plant breeder in determining relative yields of grain.

The relation between inherited nitrogen content and malting quality and between migration and nitrogen content are discussed and their economic and practical value as a basis of selection in chequer board cultures is pointed out.

Observations on field trials, the complex problems of the differential response of races to environment and of the relation between nitrogen content and brewing quality concludes the paper.

MILLETS AND SORGHUMS 633.17

852. RANGASWAMI AYYANGAR, G. N., VIJIARAGHAVAN, G., SANKARA AYYAR, M. A. and PANDURANGA RAO, V. 633.174:575.11:581.483

Inheritance of characters in sorghum—The great millet. VI. Pearly and chalky grains.

Ind. J. Agric. Sci. 1934 : **4** : 96–99.

Chalky grains have a starch-filled mesocarp about three times as thick as that of pearly grains, and are usually banded in appearance owing to the irregular deposition of starch. They absorb water more quickly and germinate slightly sooner than the pearly grains and the authors suggest that chalky grains are therefore more suitable for light soils with low moisture-retaining qualities. Pearly grains, however, are relatively less susceptible to weevil attack and also " pop " better than chalky ones.

Pearly (Z) is dominant to chalky (z), the characters segregating on a simple monogenic basis.

B. P. P.

853. 633.174:575.11.061.6

RANGASWAMI AYYANGAR, G. N., VIJIARAGHAVAN, C., SANKARA AYYAR, M. A., PANDURANGA RAO, V. and SUBRAMANYAM, P.

Inheritance of characters in sorghum—the Great Millet. IV. Brown grains.

Ind. J. Agric. Sci. 1934 : **4** : 81–89.

The simultaneous presence of two factors designated B_1 and B_2 is responsible for the production of brown colour in the grain. Each of these factors gives a brown wash to the grain over the

basic colour in yellow and red-grained plants, if the factor W determining the expression of pericarp colour be present. But in white-grained plants the presence of a B factor can be detected only by the brown colour of the dry anther. B. P. P.

854. 633.174:575.116.061.6

RANGASWAMI AYYANGAR, G. N., SANKARA AYYAR, M. A. and PANDURANGA RAO, V.
Inheritance of characters in sorghum—the Great Millet. V. Linkage between sheath-glume and dry anther-grain colours.
Ind. J. Agric. Sci. 1934 : 4 : 90–95.

A close linkage, probably absolute, exists between the genes for leafsheath colour (with which is associated glume colour) and the factors B_1 and B_2 for brown grain colour. B. P. P.

855. 633.174:576.356.5

HUSKINS, C. L. and SMITH, S. G. 633.15:576.356.5:575.125
A cytological study of the genus *Sorghum* Pers. II. The meiotic chromosomes.
J. Genet. 1934 : 28 : 387–95.

Using the same material as in previous studies (see " Plant Breeding Abstracts," Vol. II, Abst. 536) observations were taken on meiosis in the pollen mother cells.
In " diploid " *Sorghum* species 2n = 20 and 10 bivalents are usual though quadrivalents and sexivalents occur occasionally. In the " tetraploid," *S. halepense* 2n = 40 and quadrivalents, sexivalents and octovalents sometimes occur. A strain of Dakota Amber Sorgo that proved to be partially asynaptic also, revealed multivalent formations with unusual frequency.
In the authors' opinion these multivalent associations can scarcely be due to translocation, but are more likely indications of polyploidy, the existence of which is also suggested by (1) the occurrence of duplicate genes and polymeric factors reported by other workers and (2) by the frequency of duplications and deficiencies underlying the high mutation rate for certain " genes." Furthermore, the relative frequency of duplicate factors in the sorghums agrees with the cytological evidence that 10 is not their basic number. Though a 5-chromosome species, *S. versicolor*, has been recorded, the authors' material never exhibited fewer than 7 units of association, and this fact, together with the frequency of the number 7 and its multiples in the *Gramineae* suggests that 7 and not 5 may be the basic number.
The possible effect of multivalent formation on chromosome mutations is briefly discussed and its implications in relation to hybrid vigour if the latter be regarded as based on heterozygosity are considered ; and it is shewn that an allogamous polyploid should possess in addition to the specific type of hybrid vigour of its diploid ancestor also a generalized type of hybrid vigour depending on small differences between many allelomorphs. If valid, the argument reveals new difficulties in breeding for fully vigorous homozygous lines of maize.

RICE 633.18

856. RAMASWAMY, K. 633.18:581.162.3:581.466
The period of receptivity of rice stigma.
Madras Agric. J. 1933 : 21 : 514–19.

Full particulars of the method of investigation by pollinating rice flowers at various stages after their emasculation are given. The results indicated that for three days after the natural opening of the rice flowers the stigmas maintain nearly as high a degree of receptivity as on the first day, but that later on the receptivity gradually diminishes until it is completely lost by the seventh day.
The bearing of these findings on the technique of hybridization is pointed out.

857. 633.18–1.524.4(54.1)
HECTOR, G. P., SHARNGAPANI, S. G., ROY, K. P. and CHAKRAVARTY, S. C.
Varietal characters and classification of the rices of Eastern Bengal.
Ind. J. Agric. Sci. 1934: **4**: 1–80.
This is a classification of the highland, broadcast (*Aus*) and the lowland, transplanted (*Aman*) paddies of Eastern Bengal and their varietal characters are briefly discussed. Five primary groups are distinguished, *viz.* (1) translucent-grained paddies; (2) glutinous paddies; (3) winged paddies; (4) clustered paddies; and (5) double-rice paddies. Further varietal classification is based on the presence or absence of colour in the vegetative parts and in the floral organs, colour of the husked grain, consistency of grain, and the shape, size and quality of grain. The varieties are yet further distinguished into "highland *Aus*" and "transplant *Amans*" according to the season in which they are grown. Early, medium and late types are distinguished within these two groups. B. P. P.

LEGUMINOUS PLANTS 633.3

858. HENDERSON, M. R. 633.37(91)
The sources of "tuba" in the Malay Peninsula.
Malayan Agric. J. 1934: **22**: 125–30.
Means of distinguishing the two species of *Derris elliptica* and *D. malaccensis* which are commonly cultivated for tuba in the Malay Peninsula have been devised from a study of the leaf characters and habit of growth.
This information and the diagnostic key and the descriptions of certain races given should be of practical interest since the different kinds of *Derris* differ in their toxic values.

ROOTS AND TUBERS 633.4

859. SALAMAN, R. N. 633.491–2.411.4–1.521.6:575
Research in relation to the production of "good" potato seed.
Agric. Prog. 1934: **11**: 77–86.
The raising of blight-resistant varieties and virus-free stocks. Problems of Potato Growing.
Rothamsted Conferences XVI. 44–47.
In both these papers which deal mainly with the production of virus immune varieties a short historical survey of the work accomplished at the Potato Virus Research Station, Cambridge, in breeding for blight (*Phytophthora infestans*) resistant potatoes is given.
From a cross made in 1922 between *Solanum utile* and a domestic potato a large number of seedlings highly resistant to common blight both in their tubers as well as their haulms are now available. Moreover the discovery of a second biotype of *Phytophthora* (see "Plant Breeding Abstracts," Vol. III, Abst. 236) attacking these resistant stocks has been counterbalanced by the discovery that the native Peruvian variety "Aya Papa" is highly resistant to both forms of *Phytophthora*; and continued breeding and judicious crosses has yielded one seedling resistant to both strains of blight. Future work will be directed to combining resistance to both *Phytophthora* biotypes and wart disease with good economic qualities.
The necessity for financial support for future development in the control of blight and virus diseases is emphasized.

FIBRES 633.5

860. 633.51:575(54)
The Indian Central Cotton Committee: its objects, activities and achievements, with special reference to the Punjab, Sind, United Provinces and Central India.
Published by R. D. Mihra, Bombay 1933: Pp. 32.
An outline is given of the organization and mode of operation of the Indian Central Cotton Committee established in 1921 to encourage by financial and other measures the growing of improved varieties of cotton and to stimulate the production, marketing and manufacture of Indian Cotton.

Among the Institutes and numerous research projects assisted by the Indian Central Cotton Committee are the following :

A well equipped technological laboratory, the first of its kind, has been set up at Matunga and facilities are provided for thoroughly testing new strains evolved by breeders working under the provincial agricultural departments and from other sources.

The Institute of Plant Industry, Indore, opened in 1924, serves as a central research institute and investigates among other matters problems bearing on the production and improvement of raw cotton in India. A botanical survey of Indian cottons is being made with a view to ultimately devising a satisfactory systematic classification of the Asiatic section of the genus *Gossypium*. Fixed strains of the local Malvensis cotton of the Malwa tract have been isolated after 8 years of vigorous selection and it is hoped they will replace the inferior mixture at present grown in the Malwa area. New types of cotton for other districts are also being sought.

Selection and hybridization work in progress since 1931 at Ganganagar under the Bikaner Gang Canal Scheme aims at obtaining improved types of Indian and American cottons capable of spinning at least 25 counts. A series of Mollisoni selections with lint much above the average length is being investigated.

In the Punjab one of the main features of the cotton improvement scheme is a thorough study of the plant and the building up of improved strains of both local and American cottons by selection or hybridization (see " Plant Breeding Abstracts," Vol. IV, Abst. 323). Some high yielding, very early maturing American strains that spin 40's have been evolved including one N.T.43 which is also jassid resistant. Some success has also been attained in breeding long stapled American cotton with naked seeds.

In Sind a seed distribution and extension scheme was inaugurated in 1931 and variety tests are in progress.

Propaganda to popularize new varieties and the distribution of seed also forms part of the activities of the Indian Central Cotton Committee.

861. 633.51:575.113.3:581.45

HUTCHINSON, J. B. 575.17:575.24

The inheritance of leaf shape in Asiatic *Gossypiums*.

J. Genet. 1934 : **28** : 437–513.

The " leaf factor," being leaf length minus sinus length divided by lobe width, which was adopted by Leake as a measure of shape in the Asiatic cottons together with Kottur's criticism of this factor is discussed and this discussion leads to the adoption of a " Mean Index," being the mean of two further indices, as a better measure of shape. These two indices are length of leaf by sinus length and length of leaf by lobe width and, since sinus length and lobe width are highly correlated, there is a close correlation between the mean index and the leaf factor (r+0·9) and the mean index is approximately equal to the leaf factor plus 1.

It is hardly possible to give any adequate account of the various detailed results obtained from the vast assemblage of crosses and back-crosses here set out. The essential fact stands out that the leaf shape, which has been used by taxonomic workers as a character of major importance, has no taxonomic value. Of the main cultivated varieties there are two groups, broad leaved and narrow leaved respectively, separating the narrow leaved *arboreums* (L) from the broad leaved *arboreums* and the *herbaceums* (l). Here the F_1 is intermediate and the sharpness with which the three F_2 groups are separable depends on minor modifying factors.

Among the less common Asiatic cottons, however, there exist other forms which were found to possess other factors controlling leaf shape in a major degree. The first of these occurs in a form known as Burma Laciniated (L^L), with a deeply dissected leaf. L^L is allelomorphic to L and, like it, gives intermediates in the F_1 when crossed with L and l. From the Burma Laciniated were obtained as mutant branches two further forms, both broad leaved but one less so than the other. Grafted plants of these two forms bred true from the start and are termed Mutant Broad (L^B) and Mutant Intermediate (L^I) respectively. The major factors, thus, form an allelomorphic series of five numbers of which two, L^B and L^I, are almost completely dominant over all other members of the series.

Burma Laciniated is characterized by a brown lint (K) and a number of records are reported from which it is concluded that K is linked with the leaf shape multiple allelomorphic series

with about 30 per cent crossing-over. Linkage is also shown to exist between this series and genes affecting lint length, seed weight and lint percentage; a fact supporting the general observation that broad leaved types possess a finer and longer lint and a lower ginning out-turn than narrow leaved types. In one cross a further linkage was observed between the L series and the anthocyanin series (*R*).

A number of mutations were noted. In Burma Laciniated L^L mutated to L^B, L^I and l and K to k. L^I mutated to L^B and L^B to l. In one case the mutation L^B to l was accompanied by the mutation of K to k. In *cernuum* L mutated to l and there is evidence of a mutation of L^L to L having occurred. In two *arboreum* types mutations occurred of L to l in heterozygotes with Mutant Broad. As noted above, mosaics and chimaeras of two different leaf shapes were observed and formed the origin of the two forms Mutant Broad and Mutant Intermediate. In the discussion of these results it is shewn that the values of the Mean Index of the forms constitute a linear series such that $ll=0$ units, Ll 1, LL 2, L^Ll 4, L^LL 5 and L^LL^L 8 units. The bearing of this fact is discussed on the theory of " step allelomorphism " as developed by Agol and Dubinin and the theory of ' side chains ' as developed by Thompson, and a scheme aiming at unifying these two theories is presented. In this discussion the work on multiple allelomorphic series is reviewed and the bearing of the whole evidence on the theory of dominance is indicated. H. M. L.

862. Mehra, R. D. 633.51:575.42(54)
Improving the Indian cottons.
Text. Wkly. 1933: **12**: 195–96.

The variety at present grown, Hyderabad Gaorani or Bani, though one of the best indigenous varieties, has a low yield and a relatively low ginning out-turn. To produce a strain without these defects three methods were used. In the first individual plant selections were made and the data at present, though inconclusive, suggest that a few desirable types have been found of which one or more may prove a suitable substitute and may be grown as medium or short staple varieties.

An attempt is also being made to produce pure lines, each with a desirable character, which may be used in future breeding work.

The tests of the most successful varieties from other provinces shewed that none would suitably replace the existing variety. Methods of mass selection are also being used.

At present the most promising strains are being tested and it is clear that considerable progress has already been made.

863. Sankaran, R. 633.51–2.112–1.521.6
Some aspects of drought resistance with special reference to cotton.
Read at The Association of Economic Biologists, Coimbatore, Nov. 1933.

In the Madras Presidency where the predominant indigenous varieties of cotton are *Gossypium herbaceum* and *G. indicum* the former has proved the more drought resistant of the two.

A comparative study of the root system, leaf, leaf water content and the osmotic pressure in these two species was made at the Cotton Breeding Station, Coimbatore, in order to investigate their relative drought resistance.

As compared with *G. indicum*, *G. herbaceum* was found to have a deeper and thicker tap root, a denser covering of hairs on the leaves and more water in its leaves both under ordinary field conditions as well as at the stage of permanent wilting of the plant—all adaptations making for better drought resistance.

The problem of the relative importance of the morphological and anatomical structure of plants and the internal physico-chemical properties of the protoplasm in drought resistance is briefly mentioned.

864. Skovsted, A. 633.51:575.127.2:576.354.46
Cytological studies in cotton. II. Two interspecific hybrids between Asiatic and New World cottons.
J. Genet. 1934: **28**: 407–24.

This paper is a sequel to an earlier paper (see " Plant Breeding Abstracts," Vol. III, Abst. 575) and requires to be read with it, for much of the description is given in terms of comparison with forms therein described.

The material studied includes two hybrid forms, one slightly fertile having 2n = 39 and one sterile having 2n = 52, and this study is supplemented by counts of chromosomes in five plants of the first back-cross of the fertile hybrid to New World cotton and in twelve plants of the second back-cross between a New World cotton and a first back-cross with 2n = 65.

It is shewn that in the New World cottons the somatic chromosomes are of two sizes, occurring in equal numbers, 26 averaging 1·25μ and 26 averaging 2·25μ. No such difference is found in the Asiatic cottons, the chromosomes of which are indistinguishable from the large ones of the above. This distinction is traceable in the hybrids, that with 39 chromosomes having 13 small and 26 large and that with 52 chromosomes having 13 small and 39 large, indicating that the latter hybrid has arisen from the union of a normal New World pollen grain with an egg of Asiatic cotton having 26 chromosomes. Plants of the first back-cross have numbers ranging from 2n = 53 to 2n = 65 while those of the second back-cross have numbers ranging from 2n = 55 (?54) to 2n = 64.

From a study of 40 pollen mother cells of the hybrid with 39 chromosomes, in which the earlier stages of meiosis resemble those of the triploid Asiatic cotton earlier described, configurations up to hexavalents are noted but, in all, 13 is the lowest number of univalent chromosomes found. In the anaphase of the first meiotic division and in the second, a number of irregularities occur with resultant formation of monads, dyads and up to pentads.

A similar study of 20 pollen mother cells of the hybrid with 52 chromosomes again shews configurations up to hexavalents with a minimum number of univalents of 13. Nuclear fusion leading to gametes with the unreduced number of chromosomes was not observed here as in the case of the hybrid with 39 chromosomes.

In the general discussion of the observations, after pointing out certain further minor features, the writer concludes from the fact that the number of univalents is never less than 13 in either hybrid, that the chromosomes of Asiatic cotton are homologous with half the number of chromosomes in New World cotton, while the remaining half are left out as univalents, and that this finally proves that chromosome conjugation in such hybrids is due to allosyndesis. A comparison is given of configurations to shew that a hybrid comprising 26 chromosomes from New World and 26 from Asiatic cotton exhibits the same type of chromosome conjugation as a triploid Asiatic cotton, apart from the addition of an extra set of 13 univalents, further proving the homology of 1 chromosome set of the New World cotton with the 13 chromosomes of the Asiatic species. New World cottons are amphidiploid species formed by the doubling of the number of chromosomes in a hybrid between two species with the same chromosome number but with non-homologous chromosomes. This means that one of the parental types must be an Asiatic cotton or a cytologically similar species, while the other species is unknown. H. M. L.

865. SATYANARAYANA, P. 633.522:577.8

Identification of sex in ganja (*Cannabis indica* Lamk) by botanical characters.

Madras Agric. J. 1934: **22**: 3–6.

Certain morphological observations declared to be of definite diagnostic value for identification and elimination of male plants in a *Cannabis indica* Lamk when grown for ganja (which is used as a drug or for smoking purposes) are recorded. Where no flower is to be seen on the plant, sex diagnosis may with considerable certainty be based on the presence of small vegetative buds in the axils of the leaves on the main stem—an almost surè indication of a perfect or at least monoecious male plant.

SUGAR PLANTS 633.6

866. DUTT, N. L. and KRISHNASWAMI, M. K. 633.61:575(54)

The breeding of the thick type of canes for India.

Madras Agric. J. 1934: **22**: 93–96.

A brief account is given of the work, started in 1926, of breeding thick canes for southern India. Reference is made to the difficulties in determining the viability of pollen and in bridging the interval between the arrowing season of canes where these differed. A note on the origin of the various canes distributed for trial and brought into the Co. series is given and the most promising of these indicated. H. M. L.

867. ROSENFELD, A. H. 633.61:575(62)
Recent sugar cane technology in Egypt.
Int. Sug. J. 1934 : **36** : 139–40.

New varieties are mainly obtained by cross-pollination but as sugar cane never produces fertile seed in Egypt the desired crosses are made at experiment stations in tropical countries and the crossed fuzz is sent to Egypt for germination and testing. In this way at the Ministry of Agriculture some 500 new Egyptian varieties have been produced from crosses made in Mauritius, Puerto Rico, Hawaii etc. There are also about 40 new varieties at Nag Hamadi in Upper Egypt. Foreign varieties also have proved promising ; and crosses of sugar cane with sorghum made by Venkatraman (see " Plant Breeding Abstracts," Vol. III, Abst. 686) have been introduced with the object of obtaining varieties which will reach a satisfactory sugar content under the conditions of a short growing season.

868. 633.61:575.127.5:633.174
VISWA NATH, B., RAMASUBRAHMANYA AYYAR, T. S. and VARAHALU, T.
First year (1932-33) ripening tests with sugarcane x sorghum crosses.
Ind. J. Agric. Sci. 1934 : **4** : 210–27

Analyses of the juice of seven sugarcane sorghum hybrids grown at several agricultural stations in the Madras Presidency were undertaken and it was found that in the case of March-April plantings, maturity was usually attained in about nine to ten months. With the June-planted crop the period of growth was shorter but the juice was not so rich, whilst all September-planted crops analysed poorly.

Compared with other sugar cane varieties, the sorghum hybrids were richer in juice and on the whole tended to mature a little earlier. B. P. P.

869. DUTT, N. L. and SUBBA RAO, K. S. 633.61:576.311:576.354.4
A preliminary note on the membraneous body in the cytoplasm as characteristic of the indigenous Indian canes.
Ind. J. Agric. Sci. 1934 : **4** : 228–30.

In a cytological study of a number of indigenous varieties the authors failed to find any trace of the presence during the metaphase and telophase of the reduction division of the long membraneous body in the cytoplasm stated by Bremer (see "Plant Breeding Abstracts," Vol. II, Abs. 471) to be characteristic of the whole Indian group of canes. B. P. P.

STIMULANTS 633.7

870. KOSTOFF, D. 633.71:575.127.2:575.116.1
The occurrence of crossing over in *Nicotiana* species hybrids.
Current Sci. Mysore 1934 : **2** : 370–73.

In order to investigate the exchange of parts between the chromatids of the presumably homologous chromosomes of a species cross, trigenom species hybrids were obtained by crossing F_1 hybrids with a homozygous third species or parental form. Uniformity in the resultant trigenom hybrids was interpreted as indicating that the unreduced gametes formed by the F_1 hybrid were identical, while absence of uniformity indicated that the F_1 gametes must have been genetically different.

A number of trihybrid crosses made with morphologically uniform material are discussed and it is concluded that the genetical differences in the unreduced gametes which were formed in the F_1 species hybrids and were not identical are best explained by postulating crossing-over between chromosomes (especially the chromatids of the two parental species) during meiosis in F_1. The possibility of effects due to translocation or inversion or similar phenomena is also considered, but such aberrations are very rare. For such trigenom plants the term cross-over forms is suggested in preference to mutations or structural hybrids (as in the *Oenothera* " species ").

It is emphasized that the variability in trigenom species hybrids is due to structural changes in the chromatin, and not the gene, and these changes must therefore be distinguished from the gene mutations that occur following hybridization. Both types of change are of great importance in the origin of species and in phylogeny in general.

871. 633.72:581.9(54.1)
Discovery of the tea plant in India.
Nature 1934 : **133** : p. 425.
Evidence is brought forward to prove that the wild tea plant was indigenous in Upper Assam whence a sample was first sent in 1826 to India, where tea cultivation was established after 1834.

872. Wilson Mayne, W. 633.73–2.452–1.521.6:575
Annual Report of the Coffee Scientific Officer, 1932-33.
Bull. Mysore Coffee Expt. Sta. 1933 : No. 10 : Pp. 16.
Definite progress has been made in the work on the inheritance of resistance to leaf disease (*Hemileia*). Certain technical difficulties in maintaining cultures of the two strains identified in 1931-32 have now been successfully overcome.
Results from a number of coffee seedlings bred by the Experiment Station indicate that resistance to leaf disease is dominant to susceptibility and is very probably inherited as a simple Mendelian character though admittedly the number of seedlings used was too small for definite conclusions to be made. From a practical point of view it would seem that it should be possible to establish strains resistant to leaf disease in a relatively short time. Whether characteristics such as normal flowers, good set and regular fruit production and uniformity of crop can be readily combined with this resistance is being examined.
The physiological relationship between germ tube penetration in resistant and in susceptible strains led to the conclusion that the two forms of disease reaction are due to constitutional differences in the protoplasm of the hosts and not in any great degree to anatomical features.
Data are given on flower and fruit and the crop losses during the various stages of development for the year under review.

873. Voelcker, O. J. 633.74:581.162.3:578.08
On a method of controlled pollination of cacao.
10th Ann. Bull. Agric. Dept. Nigeria 1931 : 50–51.
This simple technique which has been in use for 9 months consists essentially in enclosing the flowers in a match box cover as a protection against foreign pollen.
The prevailing method of self pollination is also described.

874. Salmon, E. S. 633.79:575
Report on hop investigation at Wye College, 1932-33.
J. Inst. Brew. Lond. 1934 : **40** : 185–86.
During the past season a number of seedlings raised from C9a and other " Manitoba seedlings " crossed with different male hops and of the Bramling crossed with males from Manitoba seedlings shewed promising results, notably K1.
The results in later stages of trials of some of the older New Varieties are mentioned.

CONDIMENTS 633.84

875. Gopalaratnam, P. 633.842:581.162.3
Studies in *Capsicum*. I. Anthesis pollination and fertilization.
Madras Agric. J. 1933 : **21** : 493–509.
The data derived from this study of six types of chillies (representing four species) were collected at Guntur in two seasons during 1931–33 and provided information on the development of the flower bud, the order, duration and course of flowering, anthesis, pollination, cross-fertilization and the maturation period of the fruit.
Both self and cross-pollination occurred and the amount of natural crossing that occurred under the field conditions at Guntur averaged 7 per cent. The receptivity of the stigma and the viability of the pollen persisted for about 24 hours. The percentage set from the number of flowers produced per plant averaged six.

OIL PLANTS 633.85

876. Ali Mohammad, K. S. Ch. 633.85(54.5)
Enquiries regarding Indian oilseed crops.
Lahore, 1930 : Pp. 36 + xvi.

This is a report of a tour undertaken for the study of the practices of production and marketing of oil seeds in India.

The introduction of improved varieties is briefly discussed and attention particularly drawn to the difficulties in the case of such plants as sarson and toria (*Brassica campestris* and *B. Napus*), which are extensively cross-pollinated, and in the case of taramira (*Eruca sativa*), which is believed to be self-sterile. H. M. L.

877. Smith, E. H. G. 633.855.34–1.557
Further yields from the Calabar plantation oil palms.
10th Ann. Bull. Agric. Dept. Nigeria 1931 : 1–18.

In the course of this yield analysis the relative values of thin-shell and thick-shell palms are considered.

Plantations from unselected seed shewed great variation in the yield from individual trees. As already mentioned (see " Plant Breeding Abstracts," Vol. II, Abst. 552) breeding work has been begun and all types are to be tested with a view to the production of improved seed for planting as well as ultimately of superior strains of the oil palm.

TANNING PLANTS 633.87

878. Newman, I. V. 633.879:581.331
Polyspermy and the endosperm.
Nature 1934 : **133** : 650–51.

Cytological observations of certain abnormal cases of endosperm formation in *Acacia Baileyana* shewed, instead of the normal group of one small and two large nucleoli, various combinations of small and large nucleoli, the latter, however, invariably numbering two. From this it is deduced that sometimes there are more than two sperms in the sac. There was never any indication that more than one sperm became associated with the egg. In considering the possible sources of the extra sperm evidence is presented in favour of the view that more than one pollen tube discharges into the sac. In *Acacia Baileyana* polyspermy is indicated only in connexion with the endosperm and not with fertilization of the egg as in previous reports of the phenomenon.

RUBBER PLANTS 633.9

879. Pieris, W. I. 633.912:581.162.32
Notes on cross-pollination of rubber (*Hevea brasiliensis*) in Ceylon.
Trop. Agriculturist 1934 : **82** : 147–51.

The morphology of the flower of *H. brasiliensis* and the simple, though delicate, technique of cross-pollination and some precautionary measures against accidental fertilization are described.

In general the results obtained at Nivitigalakele during 1932 and 1933 would seem to suggest that flowers of more mature trees tend to give a higher percentage set than the flowers of young trees which have only flowered for a season or two.

The influence of *Oidium Heveae*, the effects of early winter bagging and the possibility of self-fertilization due to wind pollination of female flowers by male flowers on the same inflorescence are discussed.

In choosing the parent trees, and especially the female, robustness, general healthy appearance in relation to the size of the tree, leaf colour, previous tendency to fruit, size and appearance of flowers are regarded as important factors in obtaining a good set of seed.

Future investigations are expected to include other aspects of rubber pollination such as viability, pollen transference, natural agents of fertilization and possibilities of self-fertilization.

880. CHEEMA, G. S. 634:575(54)
Fruit research in India: its importance, history and scope.
Current Sci. Mysore 1934: **2**: 376–79.
In drawing attention to the various schemes that are now being financed by the Imperial Department of Agriculture for the development of the fruit industry, the history of fruit research in India is outlined. Almost every branch of the industry still remains to be explored and among the lines of investigation suggested are the improvement of the quality of seeds and nursery stock and their standardization which would include the selection and classification of root stocks, as recommended by the Royal Commission on Agriculture in India.
The author would divide the research on fruit into two classes, *viz.*, "central subjects" and "provincial subjects." The latter would be left to the care of the Provincial Departments of Agriculture which would organize *inter alia* the investigation of the various climatic conditions and their suitability for various crops, the selection of commercial varieties and the work of propagation.

881. STRACHAN, C. C. 634.11:575.061.6:575.252
Colour strains of the Delicious apple.
Sci. Agric. 1934: **14**: 384–99.
What is regarded as probably the first comparative study of the physical properties and chemical composition of a bud sport and its parent variety has been carried out with four distinct red sports of the Delicious apple, and the ordinary striped strain of Delicious from which they originated.
The results are of interest to the horticulturalist.

882. HOOPER, C. H. 634.23:581.162.32
Pollination in relation to cherry orchards.
J. S. E. Agric. Coll. Wye 1932: No. 30: 244–46.
A list supplementing that for 1930 of varieties of cherries given in approximate average order of flowering with varieties that appear to be good cross-pollinators.

883. CHEEMA, G. S. and BHAT, S. S. 634.3(54.7)
A study of the citrus varieties of the Bombay Presidency.
Current Sci. Mysore, 1934: **2**: 298–304.
In order to clear up the prevailing confusion about the identity and systematic position of the local varieties of citrus in the Bombay Presidency an attempt has been made to identify them in accordance with the schemes of classification of various authors.

884. OPPENHEIMER, C. and MENDEL, K. 634.31:575.252
On selecting Shamouti orange trees for budwood.
Hadar 1934: **7**: 57–58.
The problems of the role of environment as a source of variation in citrus and the moot question of the transmission of physiological characters by budding are briefly stated.
The ultimate selection and certification for budwood of 45 Shamouti orange trees out of 225 individuals under observation during 1930–33 is recorded and it is hoped that the vegetative progeny may be free from serious defects.
Experiments on the transmission of characters such as seediness and disease resistance are contemplated and are also expected, while in progress, to provide a more scientific basis for the future certification of budwood from recorded trees.

885. 634.323 Ruby
WELCH, J. H. 634.323:575.252
A new variety of grapefruit.
Hadar 1934: **7**: 68–69.
A new form of citrus that has been patented as the Ruby variety arose as a bud sport in a Texas orchard.

The outside of the fruit is pink, the flesh is crimson and the taste is the same as that of the Marsh seedless grapefruit in general. Budwood has been taken at intervals from the limb sport and the fruit from the resultant progeny trees appears to have all the attributes of the original sport.

886. 634.61:575.42
Cocoanut cultivation on the Babbur Farm.
Mysore Agric. Calendar 1934 : 50–52.
A popular article intended to demonstrate by performance records from a number of coconut seedlings of unknown parentage the great inherent variation in the individual yields and the necessity for selection and the planting of pedigree seedlings.

887. Pieris, W. V. D. 634.61:581.192:575
Studies of the cocoanut palm. I.
Trop. Agriculturist 1934 : **82** : 75–97.
In order to raise the oil content of coconuts the breeder should aim at increasing the production of copra of the individual palm. A number of variable characters were studied in detail in order to discover their value as a basis for the selection of mother trees ; and the following standards were ultimately found to be correlated with a high yield of copra : (1) a short straight trunk of even girth ; (2) short fronds well-oriented on the crown ; (3) short bunch stalks ; (4) a fair number of female flowers on the inflorescences ; (5) a large number of inflorescences carried evenly round the crown ; (6) a large number of nuts, more or less regardless of their size (the selection of varieties with numerous, very small nuts cannot, however, be recommended without further investigations) ; (7) High weight of husked nuts.
A number of other correlations between various characters and yield were also examined.

888. Swarbrick, T. and Thompson, C. R. 634.75:581.162.32
The pollination of Oberschlesien and Tardive de Leopold strawberries.
Herefordshire C.C. Agric. Quart. J. 1933 : **1** (3) : 45–52.
Some preliminary work is reported on the self-fertile Royal Sovereign strawberry as a pollinator for the varieties Tardive de Leopold which is completely self-sterile and Oberschlesien which is partly so. Field and controlled greenhouse observations shewed Royal Sovereign pollen to induce successful fertilization of both Tardive de Leopold and Oberschlesien. Pollen germination tests shewed a marked contrast between the viability and vigour of the pollen of Royal Sovereign and the poor germination of Oberschlesien. Oberschlesien was found to be unsatisfactory as a pollinator for Tardive de Leopold.
Investigations on the most suitable variety to plant with Tardive de Leopold will be continued when possible. In the meantime practical general suggestions for ensuring pollination in plantations of Tardive de Leopold are given.

889. Cherian Jacob, K. 634.771(54.8)
South Indian bananas.
Madras Agric. J. 1934 : **22** : 41–57.
The geographical origin, morphology and cultivation of the South Indian bananas are outlined and descriptions of some Madras varieties and a number of bud variants are followed by a classified and annotated list of South Indian cultivated bananas and their vernacular synonyms. The problem of improvement by breeding or selection is mentioned.

FORESTRY 634.9

890. 634.972:575.127.2
Fitzpatrick, H. M. 634.972(41.5)
The trees of Ireland—native and introduced.
Sci. Proc. R. Dublin Soc. 1933 : **20** (N.S.) : 597–656.
Some specimens of interspecific hybrids of *Populus*, *Quercus*, *Salix* and other trees are mentioned in this descriptive list of trees in Ireland.

891. SANSOME, F. W. and ZILVA, S. S. 635.64:576.356.5:577.16
Polyploidy and Vitamin C.
Bio-Chem. J. 1933 : **27** : 1935–41.
A comparison of the vitamin C content of diploid tomato strains and of tetraploid strains derived therefrom by decapitation shewed all the tetraploid strains to be about twice as active as the diploids (as determined by the prophylactic test).
There seems little doubt that a connexion exists between polyploidy and vitamin C content in the tomato. No association between genetic factors and vitamin C content was found. Previous findings on the same problem in the apple are strengthened and some interesting views about the possible phylogenetic implications are mentioned.
The question as to whether the vitamin content is under genic control rather than due to the number of chromosomes is also briefly examined with reference to *Solanum racemigerum* and *Lycopersicum esculentum*.

892. 635.64:581.48:575
Tomatoes without seeds.
Poona Agric. Coll. Mag. 1934 : **25** : 171–72.
A brief note based on information from the Free Press Journal records the production of seedless tomatoes by selective breeding of forms with few seeds.

893. WEST, J. 635.65:575.42
Bean investigations.
10th Ann. Bull. Agric. Dept. Nigeria 1931 : 61–67.
A full account of the selection work and tests of various kinds of beans, previously referred to in " Plant Breeding Abstracts," Vol. 4, Abst. 300. Brief descriptions of a large number of types of beans are contained in three appendices.

894. JAGANNATHA RAO, C. 635.657:581.162.5
A note on the occurrence of sterility in Bengal Gram (*Cicer Arietinum*).
Madras Agric. J. 1934 : **22** : p. 74.
Details are given of a case of sterility in gram similar to that previously described (see " Plant Breeding Abstracts," Vol. IV, Abst. 344). The possibility of a genetic basis of the defect is being investigated.

Part II. Foreign

GENETICS 575

895. Sapehin, A. A. 575
(L. A. Sapehin.)
Bull. Appl. Bot. Leningrad 1933 : Ser. 2 (5) : 3–4.
Obituary notice of L. A. Sapehin, with list of his published works.

896. 575:578.08
633.14-2.111-1.521.6:575
Linnik, G. 633.14:581.162.3:578.08
(New technical hints in breeding of rye).
Semenovodstvo (Seed Growing) 1933 : **2** : 20–21.
Where low temperature houses are not available for testing winter hardiness in rye it is suggested that late sowing should be carried out in small plots (2 sq. m.) with five replications and the snow should be continually removed during frosts. Some actual results obtained by this method are discussed.
Another new technique used by the author in breeding rye consisted in pollination effected by sowing the maternal plants among pedigree (élite) plots of forms intended for use as pollen parents. Hints are also given on the method of emasculation of the female plants.

897. Orlovsky, N. I. and Illinsky, B. I. 575:578.081
(The use of the field refractometer in physiological and breeding investigations.)
Nauk. Zapiski Tsukr. Prom. 1933 : (Year 10) : **34** : 105–10.
The Zeiss refractometer is recommended for determining drought resistance, cold resistance and other such characters in breeding work. The use of the apparatus is described ; and figures are given which shew that varietal differences in these characters are associated with differences in dry matter content.

898. Morgan, 575.1
(The development of genetics).
Bull. Appl. Bot. Leningrad 1933 : Ser. A (8) : 19–25.
An abridged translation of the presidential address to the sixth International Genetics Congress. (See " Plant Breeding Abstracts," Vol. III, Abst. 169).

899. 575.1(014)
Bridges, C. B. 575.12(014)
The testcross—a suggested genetic term.
J. Hered. 1934 : **25** : p. 18.
The author wishes to introduce the term testcross to indicate not a pure and simple backcross but the particular type of backcross which is used occasionally when it is necessary to introduce an additional factor. For example, in *Drosophila* the cross between a female heterozygous for Lobe (a second chromosome dominant), for lethal-IIax (a recessive lethal in II) and for speck (a second chromosome recessive) and a male of the constitution IIIax sp/Curly, should be designated a test-cross. The term backcross could then be limited to the cross between a heterozygote and either of its *parental* forms.

900. Oppenheimer, H. C. 575.1(016)
Neuere Daten zur Genetik der Pflanze. **(New data on plant genetics).**
Tab. Biol. Periodicae 1932 : **2** : 201–38.
Tables of the genera in which various phenomena have been reported, such as multiple factors, linkage, multiple allelomorphs, sex-linkage, polyploidy, allosyndesis in interspecific hybrids, reciprocal differences in crossing.
Supplements are given to earlier lists of genes known in *Pharbitis nil*, *Zea mays*, etc.

901. VAVILOV, N. I. 575.1(063)
(The Sixth International Congress of Genetics).
Bull. Appl. Bot. Leningrad 1933 : Ser. A (8) : 3–18.
An account of the Congress and a review of the contributions made in the various sections, terminating with some valuable remarks on the relative merit of genetic work in the different countries. The author particularly deprecates the divorce of pure genetics from its application (*i.e.*, plant-breeding) in all countries but the Soviet Union.

902. ZIRKLE, C. 575.12
More records of plant hybridization before Koelreuter.
J. Hered. 1934 : **25** : 3–18.
A number of documents (the earliest of which is dated 1558) describing instances of plant hybridization in various plants (*e.g.*, *Zea*, *Cucurbita*, *Pisum*, apples, melons, etc.) are quoted and extracts given in several instances, from the works of Tabernaemontanus, Matthiola, Gerard, Bauhin, Cotton Mather, Bradley, Knowlton, Henchman and Cooke, among others. A bibliography including 16th and 17th century and modern works bearing on hybridization concludes the paper.

903. 575.243:578.08
(The " Inmut " apparatus for inducing mutations in field experiments).
Z. Biol. Moscow 1933 : **2** : 202–05.
Russian version of the article referred to in " Plant Breeding Abstracts," Vol. IV, Abst. 612.

EVOLUTION 576.12

904. GAGARIN, V. G. 576.12
(Experimental analysis of the genetic-automatic processes).
Z. Biol. Moscow 1933 : **2** : 451–57.
Experimental proof is given of the action of the so-called " genetic-automatic processes " (see " Plant Breeding Abstracts," Vol. IV, Absts. 74 and 85), shewing that " the rapidity with which homozygosity is reached is inversely proportional to the size of the fraction of the population retained and directly proportional to the elimination of genes per generation."

905. KOL'TSOV, N. K. 576.12
(The problem of progressive evolution.)
Z. Biol. Moscow 1933 : **2** : 475-500.
A general dissertation on the possibility of assuming a progressive evolution, starting with atoms and passing then to molecules and finally living organisms.

906. 576.12
576.1
OSBORN, H. F. 575.31
Senescent hypotheses as to the nature and causes of evolution.
Science 1934 : **79** : p. 376. (Abst.)
The following outworn hypotheses which have been invoked in attempts to explain the nature and causes of evolution are traced back to their origins :—the origin of organs or single species by " chance " variations, Lamarckism in its original form and entelechy or an internal perfecting principle, represented in modern thought by the neovitalism of Driesch and the *élan vital* of Bergson.
The doctrine of direct environmental influence not only on the organism but on the germplasm, originated by Buffon and Geoffroy St. Hilaire is stated to be now well established. The researches of the past 25 years have revealed two distinct principles in evolution, one bearing on the origin of entirely new characters, the other on development, which is quantitative or intensive. With reference to such development new applications of Darwin's selection principle and the indirect influences of environment and habit of Buffon and Lamarck are valid.
Future research on the now wholly unknown factors in evolution should be on entirely new lines of observation and experiment.

907. Bleier, H. 576.312:575.12
Neuere karyologische Probleme und Ergebnisse. Sammelreferat. II. Arbeiten über Bastardzytologie. (**Recent karyological problems and results. Survey of literature. II. Contributions on hybrid cytology.**)
Z. Bot. 1934 : **26** : 597–626.

A most useful general analysis, from the purely cytological standpoint, of the work that has been done on hybrids. An extensive bibliography is appended, while for the earlier literature and also for an excellent exposition of the relations between cytology and inheritance in species hybrids the reader is referred to Renner's monograph on species hybrids in plants.

908. Chiarugi, A. 576.312:576.12
La cariologia nelle sue applicazioni a problemi di botanica. (**Karyology in its application to botanical problems.**)
Atti. Soc. Ital. Prog. Sci, Roma 1932 : **3** : Pp. 38.

A knowledge of the number, size, shape and behaviour of the chromosomes is of immense importance in the study of many problems of systematic botany and especially in relation to the species problem and evolution. The author discusses the most important results already obtained in this connexion.

909. Metz, C. W. 576.312.32:576.353
The role of the " chromosome sheath " in mitosis and its possible relation to phenomena of mutation.
Proc. Nat. Acad. Sci. Wash. 1934 : **20** : 159–63.

The nature and appearance of the " chromosome sheath " or envelope, a transparent and apparently gelatinous layer of material surrounding the stained chromosomes and visible under favourable conditions is discussed. Arguments are put forward to shew that the presence of such a structure might explain many of the phenomena of mitosis (*e.g.*, the definite and usually approximately equidistant spacing of the chromosomes at metaphase, the accurate alignment and approximately equidistant separation of the daughter chromosomes in late prophase and metaphase, the orientation at right angles in chromosome divergence during the split at metaphase).

Assuming that the sheath is a characteristic structural component of the chromosomes, one of its primary functions would appear to be the insulation of the chromosome proper from other chromosomes or formed bodies in the cell. Now, irradiation with X-rays or radium reduces the viscosity of the cell protoplasm and their well known effects in producing mutations and segmental interchanges might well be due to their solation of the gelatinous insulating sheath with subsequent intimate contact and interaction between the chromosomes. If this interpretation be correct it would also explain any increased mutation due to heat or other chemical substances.

910. 576.354.4:575.113
Sapehin, L. A. 633.11:575.127.2:576.356
(**The genes of the reduction division.**)
Bull. Appl. Bot. Leningrad 1933 : Ser. 2 (5) : 5–75.

Line 00180 of *Triticum vulgare* is regularly characterized by abnormalities of the reduction division, 1–2, sometimes up to 4, univalents being observed at metaphase and many more lagging chromosomes at telophase of the first division. The percentage of affected cells varies from 9 to 60, with a tendency to be higher in warm than cold years.

The F_1s of crosses of this with normal lines were entirely normal in behaviour.

Observations were made on 100 or 200 pollen grains in the F_2 and F_3 of some of these crosses and the percentage abnormality determined. Abnormalities when they occurred were in no way different from those observed in the parent. The F_2 plants were divided into those shewing below 2 per cent and those above 2 per cent abnormality, 2 per cent being the maximum observed in the normal parent. The numbers conformed almost exactly to a trihybrid scheme. The

behaviour of 22 F_2 plants in the F_3 generation confirmed this conclusion. Owing to the variability of the character and the small number of individuals however, no definite hereditary formula is suggested. After a discussion of similar results reported by other investigators the author arrives at the conclusion that the cause of the phenomenon is a particular unbalance of the nuclear constitution which makes the plant particularly susceptible to the external medium ; it is not regarded as impossible that this unbalance should be more pronounced in the F_1 than in the parents, though it is not so in the majority of cases described.

In the F_2–F_4 generations of *T. durum* x *T. vulgare* restitution nuclei, with resultant dyad formation, were observed in a number of plants, though neither the parents nor the F_1 shewed any signs of the phenomenon. The behaviour of a number of families is described, giving the numbers of bivalents and univalents present in the different plants and the proportion of diploid grains in their pollen. Part of some families was grown also in the greenhouse, where the percentage abnormality proved considerably higher than in the field, though even in the greenhouse some plants were without giant pollen grains.

Some F_2 plants were quite normal and gave F_3 and F_4 progenies entirely free from abnormality ; and out of six plants from the backcross of the F_1 to *T. durum* one developed 5 per cent diploid pollen grains but the others none. This shews that genes are again present which are responsible for the abnormalities. One F_3 plant from an abnormal F_2 was itself normal but reproduced the abnormalities in the F_4. All this goes to shew that the number of genes concerned is considerable. That the genotypic constitution and the external medium are mutually responsible is again evident.

Giant pollen grains, formed in an exactly similar way, were produced also by X-ray treatment of pure lines of *T. durum*. This and their production by backcrossing makes it seem that a 70 chromosome amphidiploid of *T. vulgare* x *T. durum* may one day be attained. By an examination of the literature on the origin of amphidiploid species and genus hybrids, it is shewn that this also is probably influenced by definite genes.

Exactly similar results to those for the percentage of giant pollen grains were obtained when the number of binuclear pollen grains due to failure of wall formation was examined in the *T. durum* x *T. vulgare* hybrids. The two phenomena were not always associated however, and are evidently due to different sets of genes.

One F_4 plant was found in which no proper side by side conjugation occurred, all chromosomes either remaining as univalents or pairing only partially (end to end). This plant is regarded as a homozygous recessive for a number of genes influencing chromosome pairing.

In the X-ray progeny two plants were found with 27 chromosomes, of which 4 formed a tetravalent. From this it is concluded that in addition to the genes controlling conjugation of the chromosomes as a whole there are others controlling the conjugation of each chromosome pair. The tetravalents are ascribed to segmental interchange.

The phenomena reported serve as very strong evidence against degree of conjugation being regarded as a criterion of relationship. The evidence from other sources is summarized. The author leans towards an explanation on the lines of Belling's theory of conjugation genes at the extremities of the chromosomes, but considers this an over-simplification ; it is probable at least that such genes are not confined to the extremities. The final solution will only be reached when the physiological side, represented by the interaction of the chromosomes and their surrounding medium, is studied side by side with the karyological and genetical aspects of the question.

911. Darlington, C. D. 576.354.46:633.15
The origin and behaviour of chiasmata. VII. *Zea mays.*
Z. indukt. Abstamm.–u. VererbLehre. 1934 : **67** : 96–114.

The shortest chromosomes generally have two chiasmata, the longer ones more, ranging from three to five in the longest of all. The reduction in number of chiasmata between diplotene and metaphase is relatively slight and only when there are two or more chiasmata is there any movement of them in the form of terminalization. The repulsion of the spindle fibre attachments thus appears to be relatively slight, as evidenced also by the presence of interstitial chiasmata and the frequency of non-disjunction in ring chromosomes.

For trivalents in trisomic plants the chiasma frequency was higher than the normal frequency for bivalents, except in one unusual plant, evidently differing genetically from the others, where chiasma frequency was lower and terminalization proportionally higher, than normal. The frequency of chiasmata in certain chromosomes was plotted against their length. The indications are that the relationship is non-linear. On the basis of these chiasma frequencies, and on the assumption that each chiasma involves crossing-over between two of the four chromatids, the expected crossing-over is calculated. The sum of the cross-over lengths so calculated is about twice that actually observed, which is accounted for by the fact that only 80 of the 200 known genes have been used so far in compiling the chromosome maps.

912. 576.354.46:633.15
576.356.2

McClintock, B.

The association of non-homologous parts of chromosomes in the midprophase of meiosis in *Zea mays*.

Z. Zellfors. Mikros. 1933 : **19** : 191–237.

The behaviour of the empty or so-called B chromosome in maize is described for plants in which one, two, and three of these are present. In presence of one only, the B chromosome most frequently folds back upon itself, its parts thus becoming non-homologously associated along its entire length. When two are present each may do this, but usually normal pairing between the two occurs. In presence of three, complicated figures, where both homologous and non-homologous association take place, are observed. In continuation, descriptions are given shewing a similar type of association on the part of univalent chromosomes in monosomic plants and the 3 homologues in trisomic plants. In certain other plants, one chromosome of which possessed an inverted segment, normal conjugation occurred, necessarily involving the pairing of non-homologous parts. Figures are given for the frequency of occurrence of a chromatid without the attachment constriction resulting from crossing-over in the inverted segments of chromosomes with an inversion. The presence of a large inversion is associated with a frequent lack of pairing at the inversion end, which in the presence of an extra inversion chromosome often leads to the separation of some chromosomes from the group of five. Small inversions in the neighbourhood of the spindle fibre attachment do not affect the synaptic configurations, but when the length of the inversion is greater, inversion synaptic configurations are regularly observed. In chromosomes whose partners have suffered a deficiency the unpaired section is observed to enter into non-homologous association with itself, and with unpaired sections of other chromosomes.

Observations on the pairing of a ring-shaped chromosome deficient in both ends with a normal rod-like homologue revealed cases of non-homologous association in the unpaired sections sometimes leading to buckling ; it also revealed cases of the shifting of the spindle fibre attachments, bringing them together, in chromosome 2 where they never come together normally. This suggests that the attachments play a greater part in chromosome association when the ends are absent than they do in the normal course of events. In cases of extreme deficiency the ring tends to collapse, both it and its normal homologue each folding upon itself ; similarly with two small ring-shaped chromosomes.

Non-homologous association is frequently observed in chromosomes that have suffered reciprocal translocation, two-by-two pairing being carried on beyond the region of homology. Further, fold-backs and other configurations involving non-homologous association are shewn to be not uncommon in many normal diploid plants and association of whole chromosomes or sections thereof is observed in monoploid plants ; many so-called cases of asynapsis are thought to be the result of early separation of chromosomes paired non-homologously.

An examination of the entire evidence shews that there is a tendency towards two-by-two association at prophase, even though the parts associated may not be homologous. The association begins at the ends, regardless of homology. Though as close as homologous pairing, non-homologous association rarely continues into diakinesis.

Examples are given where as a result of non-homologous association of the kinds mentioned above, new chromosome types have been formed and this process is considered to be a common source of translocations ; this is illustrated by reference to the formation of chromosome fragments and of secondary trisomics from ordinary trisomics and of bivalents in monoploid plants.

913. HEILBORN, O. 576.356.5
On the origin and preservation of polyploidy.
Hereditas 1934 : **19** : 233–42.
Twelve hypotheses advanced by various investigators and dealing with the differences in the occurrence and frequency of polyploidy in various groups of plant and animal organisms are briefly stated in chronological order.
The high frequency of polyploidy as developed in many angiosperm families must, it is concluded, be due in some degree to combined effects of several coincident factors, namely :—(1) the occurrence of somatic doubling or the production of unreduced gametes ; (2) a low degree of cell-constancy ; (3) possibilities for self-fertilization ; (4) capacity of enduring a change from separate sexes to hermaphroditism ; (5) double fertilization, parthenogenesis or other incompatibility barriers which prevent the swamping of the newly established polyploids by crossing with the diploid parents ; (6) chromosome conditions favouring regular meiosis in the polyploids. Should one or more of these conditions be lacking, polyploidy becomes rare or may be altogether absent.

914. 576.356.5:581.07
KOSTOFF, D. and KENDALL, J. 581.143.32:576.356.5
Studies on plant tumors and polyploidy produced by bacteria and other agents.
Arch. Mikrobiol. 1933 : **4** : 487–508.
A brief review of previous work (see " Plant Breeding Abstracts," Vol. III, Abst. 125, Vol. IV, Abst. 922) with additional data confirming earlier explanations and interpretations on tumour formation in hybrids (especially in *Nicotiana*), tumour production by chemical agents and by infection with *Bacterium tumefaciens*, and the biochemical aspects of the aetiology of tumours. The production of polyploid shoots in plants parasitized by *B. tumefaciens* suggests a possible role for plant and animal parasitism in the origin of species.

BOTANY 581

915. PRÁT, S. 581.04:631.521.6:575.41
Die Erblichkeit der Resistenz gegen Kupfer. (**Inheritance of resistance to copper.**)
Ber. deuts. bot. Ges. 1934 : **52** : 65–67.
These experiments which are to be continued concern a case of probable natural selection of a race of *Melandrium* differing from the usual forms in being able to stand a very high copper content of the soil.

916. LAIBACH, F. 581.14:577.17
Zum Wuchsstoffproblem. (**The problem of growth substances.**)
Züchter 1934 : **6** : 49–53.
A critical survey of the results so far obtained in research on plant hormones. The importance of this field of investigation for experimental morphology, developmental physiology and the study of stimuli reactions is made clear ; and attention is directed to its possible practical applications in promoting fruit formation or prolonging the life of the embryo derived from certain fruit crosses (*e.g.*, *Prunus avium* L.) in which sterility is due merely to the premature death of the embryo owing to somatic influences.
Other hormones, such as the root forming substances, which are of importance in the developmental physiology of plants, will, it is believed, also play their part in plant breeding.

917. MARTIN, J. H. 581.143.26.03
Iarovization in field practice.
U.S. Dept. Agric. Bur. Pl. Ind. 1934 : Pp. 13. (Mimeographed.)
Vernalization is not a new phenomenon and experiments are quoted from the middle of the last century where by the application of low temperatures to the seed winter cereals were induced to head when spring sown.

Experiments have been made to test the possibility of using vernalized winter wheat as a substitute for spring wheat or for re-seeding winter wheat which has failed. Vernalization was successful but the yields did not compare favourably with those of spring wheat, still less with those of winter wheat autumn sown. The length of time required for successful vernalization, in many varieties amounting to 65 days, is another drawback which deprives vernalization of its advantage over winter seeding or the use of a spring variety. The practical and economic difficulties of applying low temperature treatment on a large scale are mentioned as a further very serious drawback.
Experiments to test the efficacy of high temperature vernalization applied to sorghum have all so far given negative results. The process in this case moreover is still more difficult of application on any large scale.
The author is of the opinion that the value of vernalization is largely confined to its use in experimentation, as for instance by breeders to procure two generations in one year.

918. MARTIN, J. H. 581.143.26.03
The practical application of iarovization.
J. Amer. Soc. Agron. 1934 : **26** : p. 251.
A short note on the results reviewed in the preceding abstract.

919. SCHRIBAUX [AND] FRIEDBERG. 581.143.26.03:633.11
La printanisation des blés. (**Vernalization of wheats.**)
C.R. Acad. Agric. Fr. 1934 : **20** : 218–28.
The possible value of vernalization under French conditions is discussed. From a series of experiments with 18 types of wheat at the Station Centrale d'Amélioration des Plantes at Versailles, it is concluded that vernalization might be of use where extreme cold has destroyed the autumn sowings, provided sufficiently low temperatures occurred in January and February. A comparative test of vernalized and spring varieties is in progress.
Vernalization could be used to determine the capacity for very late earing in the lines derived from a cross.

920. LEBEDINCEV, E. 581.143.26.03:633.11
(**The significance of the day length for the earing of winter cereals.**)
Bull. Appl. Bot. Leningrad 1933 : Ser. 3 (3) : 141–54.
Experiments are described which shew that extension of the length of day retards ear emergence in winter wheat under normal conditions but after pre-treatment with reduced temperatures (O°C.) for a fortnight or one month, such lengthened day accelerates ear formation.

921. NAVASCHIN, M. 581.163:575.148
(**A new possibility in plant breeding**).
Semenovodstvo (Seed growing) 1933 : **2** : 11–17.
A direct application of parthenogenesis and androgenesis for breeding purposes is discussed in a popular form. These modes of reproduction would save considerable time in building up varieties and, owing to an entire absence of segregation, would make it possible to produce truly homozygous progeny.

922. KOSTOFF, D. 581.143.32:576.356:575.24
Tumor problem in the light of researches on plant tumors and galls and its relation to the problem of mutation. (A critical review from biophysical, biochemical and cyto-genetical point of view).
Protoplasma 1933 : **20** : 440–56.
This stimulating critique deals first with the origin and nature of tumours in interspecific crosses, especially in *Nicotiana*, and the possible biochemical reactions underlying their production. The histological and cytological resemblances between plant galls and natural or induced plant hybrid tumours are then examined ; incidentally the question is raised as to whether the polyploidy in wound calluses which follows decapitation may not be due to bacterial action instead of traumatic effects.

The cytological similarities between the phenomena found in plant tumours and galls and those typical of animal and human cancer and certain physiological and biochemical reactions in tumours are described and the occurrence of tumours in hybrid animals and the age of incidence in man and in plants are touched upon.
This array of facts is then considered in the light of the numerous hypotheses on the aetiology of tumours with special reference to Baur's mutation theory.
As a working hypothesis the author, rejecting the mutation theory, suggests that changes in the formative substances of the cell (such as result from chemical and other agents) involving modification of the specific proteins by precipitation, dissolution, etc., are responsible for " despecialization " or degradation of the cell which thus becomes a " reduct " in which many formative substances (and occasionally certain hereditary units) are destroyed or changed. Despecialization is followed by the appearance of defective organs and possibly, at a later stage, of tumours. In other words the various aberrations found in tumours, *e.g.*, irregular cell division, polyploidy, heteroploidy, etc., are regarded as the result rather than the cause of tumour formation. (See also " Plant Breeding Abstracts," Vol. IV, Abst. 914).
A bibliography of recent work on the subject is appended.

AGRICULTURE 63

923. RADDE-FOMINA, O. 63.00.15(47)
(The work of the Kiev Institute of Botanical Research.)
Priroda (Nature) 1934 : No. 3 : 106–08.

The Institute has grown out of the former Botanical Garden of the University of Kiev, its development as an independent institute since 1923 is briefly traced.
The laboratory of morphology and systematics has studied the flora and zonation of the Ukraine, the laboratory of plant physiology has investigated the anatomy and physiology of a number of potato varieties, giving results of some interest to breeders, together with vernalization and other questions of theoretical interest. The cytological laboratory has made studies on the reduction division in the higher plants, on the embryology of the beet and the cytology and systematics of the genus *Reseda* and others.

924. MAROTTA, F. P. 63.00.15(82)
La obra del Decanato, docente y administrativa Nov. de 1927—Mar. de 1931. **(The work of the Deanship, teaching and adminstrative, Nov. 1927—March 1931.)**
Universidad de Buenos Aires 1933 : **1** : Pp. 470 : illus.
MAROTTA, F. P.
La obra del Decanato cultural, profesional y deportiva, Nov. de 1927—Mar. de 1931. **(The work of the Deanship, cultural, professional and recreational. Nov. 1927—March 1931).**
Universidad de Buenos Aires 1933 : **2** : Pp. 488 : illus.

A genetic faculty was started in 1927. The plan of work consisted of studying the genetics of the local plants cultivated and wild, to improve them by genetic methods and to prepare suitable material for teaching. This includes the genetics of various recessive defects in maize, resistance to crown rust in oats, to *Phlyctaena linicola* in flax and the cytology of various plants, including *Agave*.
The report of the scholarship section contains accounts of a study tour to genetical institutions of Germany and Russia, two other tours to those of the U.S.A.
Volume II contains reports of addresses, including one by Professor Jerónimo Azzi on " The relation between agricultural ecology and genetics," in which the importance of using country varieties (" land races ") for hybridization, in order to retain the natural adaptation to local environment, is emphasized. The value of wild species is illustrated by reference to the extension of apple cultivation northwards by means of hybrids with *Pyrus Baccata*.

Reports are also given of a series of lectures by the late Professor Erwin Baur on " The problems of modern genetics to-day," " The problem of evolution in the light of recent experiemntal investigation," " The application of modern genetical investigation to plant cultivation and stock breeding " and " The experimental production of mutations." Lectures were given to students on " The series of unilocal factors in *Antirrhinum*," " The methods of raising and improving fruit trees," " The organization of studies in pure genetics and agronomy in Europe, especially in Germany, Sweden and Russia."

925. Jurin, P. 63.00.15(061)(47)
(Summary of the Voronej session of the Lenin Academy of Agricultural Sciences.)
Bull. Appl. Bot. Leningrad 1933 : Ser. A (8) : 217–20.
A very brief outline of the problems set up for solution in the second Five Year Plan in all branches of agricultural science, including plant breeding.

926. 63.00.15:551.566.3
Eichfeld, I. G. 575:633:551.566.3
(Struggle for the far north.)
Lenin Acad. Agric. Sci., Inst. Pl. Ind., Leningrad 1933 : Pp. 46.
A description of the work and achievements of the Polar Division of the Institute of Plant Industry, situated at a latitude of 67°44′ N., the most northerly agricultural research station in existence. Cultivation has for the first time been made possible in these regions, largely owing to the introduction of the whole world resources of cultivated plants for trial. In addition to the typical northern forms, successful introduction has often been effected with hill forms from the mountains of Tunis, Algeria, Abyssinia and Afghanistan. The adverse effect on reproduction of the continuous illumination is counteracted by the low temperatures (see " Plant Breeding Abstracts," Vol. IV, Abst. 920). This was specially marked with potatoes, which developed abundant tubers and behaved as long-day plants at temperatures of 12–15°C but behaved quite differently at higher temperatures. The potatoes were also remarkably free from disease. Successful forms of oats and barley have been selected and crosses have been made between these excessively early forms and high-yielding varieties from the south. Some of these hybrids shew great promise, *e.g.*, oats from Ligowa x D.S.11. Winter rye, spring wheat, peas and fodder grasses have also received attention ; also a number of new root crops and vegetables. Innumerable plants capable of growing on the reclaimed bogs have been found. There are indications that an oat can be created which retains its green leaves up to the time of ripening and can thus be used both for grain and for fodder. Many of the southern cross-pollinated crops when brought north shewed the most complicated segregation into a number of different types. This occurred even in highly selected Swedish and Danish strains of vegetables. From these segregating populations ecotypes adapted to the local conditions are being selected. Many of the vegetables have a very high vitamin C content and selections are also being tested for this.
Twenty American species of potatoes are being examined. The species *Solanum acaule*, *S. demissum* and *S. andigenum* are specially favourable for breeding for frost resistance, *S. Rybinii* for early maturity and the variety Kaiseda of *S. andigenum* for high starch content.
Considerable work has been done on growing potatoes from seed in the case of those varieties which give a sufficiently uniform progeny.
The local wild raspberries and blackberries are very valuable for breeding because of their earliness and resistance, and the Kola Peninsula has revealed a great richness of the various bilberries, cloudberries, etc., which should be capable of extensive utilization.
By vernalization many varieties of wheat and barley were made to develop ripe grain which under normal conditions do not even come into ear at Khibiny. Applied to the whole collection of wheats, vernalization accelerated ear development by 2–4 days in the majority of varieties, by 5–10 days in 12 per cent of the varieties and by more in 17 per cent. In 8.5 per cent of the varieties no change was produced and in 1·5 per cent a retardation.

PLANT DISEASES 632

927. KINGSLEY, E. L. 632.451.2:576.16
The relation of certain morphological characters of the host and fungus to the identification of the loose and covered smuts of oats.
Trans. Kans. Acad. Sci. 1933: **36**: 98–104.
Observations on *Ustilago avenae* and *U. levis* shewed no consistent or easily recognized morphological differences in the characteristics of the smutted panicle affected by physiological forms of oat smut or between oat varieties infected with the same form.
One important diagnostic character for the two species is described. Some possible instances of infection by a hybrid fungus of *U. avenae* and *U. levis* are mentioned.

928. SPRAGUE, R. 632.482:633.13:576.16
A physiologic form of *Septoria tritici* on oats.
Phytopathology 1934: **24**: 133–43.
The author claims to have identified a new physiological form of *Septoria tritici* Desm., found on autumn sown oats in western Oregon. A full technical description of the fungus is given.

929. 632.5:633.85(47)
KHREBTOV, A. A. and DVORNIKOV, V. S. 633.85:665.3
(The weeds of the Urals, as oil producing plants.)
Bull. Inst. Rech. Bio. Perm. 1933: **8**: 259–64.
Investigations of the seeds of a number of plants growing wild and as weeds have shewn them to be richer in oil than many of the common cultivated oil plants. An expedition was sent to the Ural zone to study the weed plants in more detail from this point of view. The frequency of occurrence of 25 different species, of which nine were Cruciferae, in the various regions of the zone is indicated in tabular form. Seeds of fourteen of these species were analyzed. The oil content of the seeds varied from 14·8% to 41·8%, compared with about 31 for hemp, 37 for linseed, 20 for soya bean and 45–60 for lentils.
The authors are convinced that extensive use might be made of these wild plants.

ECONOMIC PLANTS 633

930. 633:575.127
MORITZ, O. 633.11:575.127
Die botanische Serologie. **(Botanical serology.)**
Beitr. Biol. Pfl. 1934: **22**: 51–90.
An extensive survey of the serological work that has been done at Kiel on plants. Various methods, techniques and apparatus are described. The biochemical interpretation of the results and the actual and the possible applications of the method are considered and the work on plant relationships in various crop and other plants is mentioned.
A bibliography of recent work is appended. (See " Plant Breeding Abstracts," Vol. IV, Abst. 380).

931. 633–1.524
(Decree of the Council of the Lenin Academy of Agricultural Sciences of May 13, 1932.)
Bull. Appl. Bot. Leningrad 1933: Ser. A (8): 221–25.
(On the collections of the plant resources of the world in the possession of the Institute of Plant Industry.)
Bull. Appl. Bot. Leningrad 1933: Ser. A (8): 227–30.
An outline of the system to be applied by the Institute of Plant Industry in maintaining and multiplying the world resources of economic plants in its possession, including the recording of the information regarding each specimen and the apportioning of the work and material to special institutes and zonal stations.

932. HANSEN, H. P. 633–2–1.521.6:575
Inheritance of resistance to plant diseases caused by fungi, bacteria and vira. [*sic.*] **A collective review with a bibliography.**
Kgl. Veter. Landbohøjsk. Kbhvn. Aarsskr. 1934 : 1–74.
A summary compiled by the author with the object of providing a general survey and bibliography of all the existing literature on the inheritance of disease resistance in plants. The bibliography of 250 references is classified under authors and under host plants.

933. 633–2–1.521.6:575
FROMME, F. D. 633.15–2–1.521.6:575
Current research in the plant sciences at the West Virginia Agricultural Experiment Station.
Proc. W. Va. Acad. Sci. 1933 : **6** : 22–25.
The work of the Department of Agronomy and Genetics on the genetic basis of disease resistance and its linkage with certain morphological characters is mentioned with particular reference to the studies on smut in maize and in oats. A vigorous, smut resistant, high yielding type of maize is still being sought. The breeding of water melons resistant to *Fusarium* wilt and of tobacco resistant to root rot has also been receiving attention.

934. 633.0014(48.5)
633(48.5)
A. Z. 633.16 Maja
Sorter och utsäde. (**Varieties and sowing.**)
Skånsk JordbrT. 1934 : Nr. **13** : 197–99.
A popular article in which among a number of new barleys the Maja variety which was (see " Plant Breeding Abstracts," Vol. IV, Abst. 991) developed in Denmark is recommended for its high yield and stiff straw. It is about as early as Kenia (another Danish production) which is, however, superior in malting quality. Other new or fairly recent wheat types from Svalöf and also the results of potato trials are very briefly noted.

935. MAYR, E. 633.1:575:581.5(43.6)
Die Bedeutung der alpinen Getreidelandsorten für die Pflanzenzüchtung und Stammesforschung mit besonderer Beschreibung der Landsorten in Nordtirol und Vorarlberg. (**The significance of the alpine land races of cereals for plant breeding and pedigree investigations with special descriptions of the land races in the North Tyrol and Vorarlberg.**)
Z. Züchtung 1934 : A **19** : 195–228.
The aim of these investigations was to compile an inventory of all the land races of the four main cereals and of maize growing in Austria and a geographical survey of cereal cultivation in the alpine parts of Austria and to discover whether any of these land races had any value for breeding purposes.
The geography, geology, climate and distribution of the cereals in the different districts is briefly given and the land races described.
The oldest land wheat in the alpine valleys is *Triticum compactum* and it is suggested that here, as in Vavilov's gene centres of South West Asia, there has occurred a segregation of the recessive lax eared type which prevails in the lower valleys.
Of winter wheats the oldest land race of the northern alpine valleys is *T. vulgare* var. *erythrospermum* Kcke. *T. monococcum* occurs in some places but *T. dicoccum* has not been found. *T. Spelta* is now considered to have arisen either from natural crossing between *T. dicoccum* x *T. vulgare* or *compactum* or as a mutation from either of the two latter forms.
The data on barley shew that from the point of view of plant breeding for the most exposed parts with severe winter and low soil temperature in spring, the only suitable variety is the 6-rowed barley of Montavons which can be regarded as a valuable parent. In other exposed districts at the limit of cereal cultivation occur awned and unawned types of 4-rowed barley. For exposed and very rainy districts the dense-eared barley is the most suitable and the lax-eared for dry parts.

The 6-rowed barley is after *compactum* wheat and *monococcum* the oldest land cereal. The 4-rowed barley which now replaces the 6-rowed in many parts cannot, in the author's opinion, have arisen as a mutation from the former and its origin remains obscure.
Oats are grown in most parts of the Tyrol but without much attention. Maize is quite extensively cultivated and all the varieties belong to the group *Zea mays vulgaris* Kcke. In one district maize ripens yearly at 1,100 m. above sea level. The seed is resown each year as no other variety will ripen.
It is clear that these districts possess forms of the various cereals which have disappeared from other parts and should be preserved as they probably have a value for breeding.

936. 633.1:575.11
DIX, W. 633.1:575.24:578.088
Züchtungsversuche mit Getreide. (**Breeding experiments with cereals.**)
Landw. Jb. 1934 : **79** : 335–69.

Plants of Heines Hanna barley, Strubes roter Schlanstedter and Garnet spring wheats were treated at the time of tillering with X-rays and ultra-violet rays and with 5 and 10 per cent solutions of hydrochloric acid, nitric acid, caustic soda, ether, chloroform, ammonia, acetic acid and corrosive sublimate. The different crops shewed different reactions to the various treatments.
The most marked effects, apart from the damage caused by the treatment was the appearance of a number of awned ears of Garnet wheat, one awned plant of Strubes roter Schlanstedter, a double ear of this latter variety and one of barley.
The seeds of these plants were sown and none inherited the abnormalities of the parents or shewed any characters of value to the plant breeder except in one progeny of Garnet wheat treated with 10 per cent acetic acid, one plant of which was 10–15 cm. taller than the rest, awned, red-brown in colour and ripened 10 days later than Garnet. It had however a better set of grain and more spikelets per ear.
The progeny of the plant was not constant but segregated into 48 different types based on time of ripening, ear colour, awning, culm length and ear length.
Seed of these types was sown and produced besides the parental types still different forms, in all 156, whose main characteristics are given.
Among these types was a variation in culm length of 90–150 cm., in colour from white through red to black, all degrees of awning, number of spikelets per ear 14·0–25·4 and ear density 1·30–3·14.
The next year's sowing shewed that 90 per cent of these types bred true and that the segregation in the remaining 10 per cent was only for a few characters.
The author's explanation for this astonishing result is based on the theory of genules (see " Plant Breeding Abstracts," Vol. II, p. 98). It is hoped later to examine these plants cytologically.
In a series of experiments with the progeny of a 2-rowed hooded barley which occurred in a plot of 6-rowed hooded barley and with other plants, cases were found of plants with both awns and hoods, a character which was inherited but not in Mendelian ratios. These plants occurred more commonly among the progeny of hooded parents. Such cases cannot be explained by the presence or absence theory as both the dominant and recessive characters are expressed in the same plant but an explanation is possible on the lines of the author's intensity theory. Further examples of the appearance of a factor pair in the same plant are given by the progeny of crosses between two varieties of rye, some plants of which shewed both short and long stemmed ears and by barley hybrids which shewed upright and drooping ears.
The abnormality in wheat known as " Fliegenkopf " may occur on the same plant as normal ears and all intermediate stages may be found. The partial sterility in rye behaves in the same way.
Further experiments with varieties of wheat which were treated with X-rays at the time of fertilization shewed a number of inherited variations, especially difference in length of straw. The cases in which the inheritance does not follow Mendelian laws are explained by the author as due to a " loosening " of the germ plasm which occurs normally during fertilization but is

also brought about to a greater or lesser extent by the use of chemicals, rays, changes in the temperature, etc., and may even cause a loosening of the genes themselves so that other combinations result from the union of the gametes.
There is no essential difference in principle in the author's opinion between cross-fertilization and mutation. In the latter the impetus to loosening is given by the male gamete and in the former by the externally applied stimulus.

937. Piescu, A. 633.1:581.143.26.03
Incercări de scurtare a perioadei de vegetaţie la cerealele românești după metoda lui T.D. Lyssenko. (**Experiments on the shortening of the vegetative period of Rumanian cereals by the method of T.D. Lyssenko.**)
Viaţa Agric. 1933 : **24** : 523–30.
The experiments were made on ten winter and five spring wheats and seven barleys of Rumania, four German winter wheats, six winter and one spring wheat from Sweden, two American winter wheats, three winter and two spring wheats from Russia and one Danish winter wheat.
The grain was vernalized and plots were sown as follows :—" a," control plants sown in the spring, " b," plants from vernalized seed, and " c," winter varieties sown in the autumn.
The majority of the winter cereals from vernalized seed developed the habit of spring plants. Some foreign varieties from maritime climates behaved like winter cereals sown in the spring.
The vernalized plants " b," headed some days later (according to the variety) than the control plants " c." The " a " plants headed about ten days after the " b " plants. The vernalized spring varieties headed at the same time as the control " a" plants.
Data are given on the date of harvesting and the yield of the three groups.
In conclusion it appears that some, but not all, varieties respond successfully to vernalization.

938. Timopheeva, M. T. 633.1–2.111–1.521.6:578.081
(The dynamics of frost resistance in winter cereals and the characteristics of varieties from the point of view of their hardiness.)
Bull. Appl. Bot. Leningrad 1933 : Ser. 3 (3) : 253–72.
Direct observations were made on twenty-five varieties of winter wheat and 6 varieties of winter rye by artificial freezing of the plants grown in boxes, each box containing a standard variety as control. The freezing was performed at intervals throughout the winter.
The frost resistance in general diminished as the winter progressed, this being more regular in some varieties than others. Temperatures of –18°C. were fatal at the end of the winter, whilst –22 to –24° were endured at the beginning. The sugar content of the plant also diminished.
Certain varieties proved resistant at all periods of the winter, *e.g.*, *erythrospermum* 1114, 1199 and 1218, *Lutescens* 329, Minhardy ; others were at all times the least resistant. Other varieties, 16 in number, displayed differing degrees of resistance according to the period ; resistance generally tended to increase with the approach of spring, in some cases conversely.
Indirect methods of determining the frost resistance gave conflicting results which did not by any means correspond to those obtained by the direct method.
The behaviour of each variety in the course of the experiment is described.
The variability at different periods was even more marked in the rye than the wheat varieties.
Some of the less frost resistant varieties overwintered just as well near Leningrad as the most resistant and it is concluded that frost resistance is not the only factor which determines the survival or loss of a variety in winter.

939. 633.1–2.452:576.16
Ciferri, R. 633.1–2.452
Recentissime vedute intorno al problema delle ruggini dei cereali. (**Recent views on the problem of rusts of cereals.**)
Ital. Agric. 1934 : **71** : 128–39.
This is a resumé (for Italian readers) of some of the recent views on the rust problem : it is based almost exclusively on North American and Canadian results, the scientific contribution of the

German and Latin races in this particular field being stated to be very small. The following aspects are considered : specialization, heterothallism and the formation of new lines of rusts, the barberry problem, the difficulty of identifying lines of rusts, the utilization of lines of rusts for purity and selection tests of races of grain, the practical significance of the lines and specific forms of rusts, and finally preventive measures.

940. TAMM, E. and SCHRENK, A. 633.1.00.14
Über die Auswertung mehrjähriger Sortenversuchsreihen. (**The interpretation of series of variety trials running over a number of years.**)
Züchter 1934 : **6** : 88–96.

An examination of the results of variety trials of various cereals carried out since 1929 shewed that the highest yields were given always in those places with the highest rainfall in the period April to July. In interpreting the results, therefore, it was decided to consider the places with high and low rainfall separately. A further subdivision was made according to soils, light, medium or heavy. Tables are given illustrating the recommended manner of giving the results. The values are given as a percentage of the mean of each group and are comparable therefore only within the groups. It was clear, however, that certain varieties were regularly above the average, others always below, while some were successful under certain sets of conditions but not under others.

WHEAT 633.11

941. BERG, S. O. 633.11 Ergo
Weibulls Ergovete. Ny, tidig och mycket vinterhärdig höstvetesort med ypperlig stråstyrka. (**Weibull's Ergo wheat. A new, early and very winterhardy winter wheat variety with excellent strength of straw.**)
Weibulls Årsbok 1934 : **29** : 20–21.

Ergo wheat, from a cross between Ankar I and Jarl has been compared with Jarl in a number of different places. On the average its yield has been markedly higher than Jarl and it has a considerably better strength of straw. In the rainy districts of west Götaland it has shewn itself to be in the same class with the best variety of southern Sweden. It is rather earlier than Jarl and is nearly equal to it in winterhardiness. It has a very high hectolitre weight and its baking quality seems good.

942. 633.11 Sampo
PESOLA, V. A. 633.11 Sampo(47.1)
Sampo-vehnä. (**Sampo-wheat, a new Finnish winter wheat variety.**)
Valtion Maatalouskoetoiminnan Tiedonantoja, Porvoossa 1934 : No. 73 : Pp. 6.

Sampo wheat was bred from a cross made in 1920 between the Svalöf winter wheat Thule II and the Finnish native winter wheat in order to combine the strength of straw and stripe rust resistance of Thule II with the winter hardiness of the Finnish indigenous wheat.
Five years testing have shewn that Sampo is superior to a very good native variety Jalostettu maatianinen and the pedigree varieties Elsa and Sukkula II. In winterhardiness Sampo nearly equals its Finnish parent and in rust resistance and strength of straw it resembles its Swedish maternal parent.

943. PESOLA, V. A. 633.11(47.1)
Tärkeimmät kevätvehnälaatumme maatalouskoelaitoksen kasvinjalostusosastolla Jokioisissa suoritettujen kokeiden valossa. (**The most important varieties of spring wheat in Finland based on comparative cultural experiments of the Plant Breeding Division of the State Research Institute, Jokioinen.**)
Valtion Maatalouskoetoiminnan Tiedonantoja, Helsinki 1934 : No. 74 : Pp. 13.

Among the Finnish strains included in trials with Swedish and other foreign varieties, Sopu and Hopea are regarded as promising for Finnish conditions. Sopu is earlier than the Swedish spring wheat Timantti, outyields the Finnish variety Hankkijan by about 5 per cent, has a stiff straw, fairly good rust resistance and suitable grain and baking qualities. Hopea seems to excel in high baking quality, the growing properties also being good or fair.
Sopu and Hopea are new Finnish strains bred from Canadian Marquis crossed with Hankkijan ruskea.
None of the foreign spring wheats proved specially suitable for growing in Finland as compared with the Finnish forms.

944. 633.11:575
633.11 Mouton à épi rouge
CRÉPIN, C. 633.11 P.L.M.1
Deux bons géniteurs " blés." (**Two good wheats for breeding material.**)
Sélectionneur 1933 : **2** : Fasc. 4 : 45–49.

The necessity for balancing the defects of one otherwise desirable parent in a cross by the qualities of the other parent is exemplified by an instance from the author's unsuccessful attempt to breed a cold resistant wheat. Subsequently, however, in 1933 the defective parent, Alsace, was replaced by Mouton à épi rouge and P.L.M.1 which shew not one single outstanding characteristic but good all round qualities of resistance to cold, to black and to yellow rust, earliness and good baking quality. A number of other varieties are cited with which the two above mentioned should be crossed to produce suitable types for the various regions of France with their different climatic conditions. The breeder must, however, be on the look out for any undesirable characters inherent in either parent, such as the tendency to lodging and susceptibility to rust which may crop up in later generations and must be eliminated by selection. One cross in particular, Jarl x P.L.M.1 has already in F_2 yielded what should prove a wheat with excellent qualities and also resistant to lodging.
Ducomet's work on Aquitaine wheat (see " Plant Breeding Abstracts," Vol. IV, Abst. 650) is referred to and if crossed with this wheat, the two types Mouton à épi rouge and P.L.M.1 are regarded as likely to produce valuable progeny.
Breeders are recommended to inform themselves of disease resistance of the different varieties in the yearly trials carried out by the various official stations.

945. 633.11:575(82)
D'ANDRÉ, H. 633.11:664.641.016(82)
Valor industrial comparativo de trigos comerciales y en experimentación. (**Comparative value of commercial wheats and wheats under trial.**)
Bol. Minist. Agric. B. Aires 1933 : **33** : 421–50.

Comparisons of the local country wheats, imported varieties, commercial pedigree varieties and local hybrids not yet released, demonstrated the superiority of some of the latter as regards milling and baking quality. Comments are made on the results given by the different varieties and hybrids at a number of stations in different localities.
Forty different wheats in all were studied ; the variety 38 M.A., being one of the highest in quality, was taken as standard. Of the 25 hybrids tested, the hybrids of (B x R–C) x San Martín, Vencedor (Victor) x Lin Calel (" La Previsión 28 ") and San Martín x Pagador occupied first place. The following were also distinctly promising : Kanred x Pagador, Vencedor x Kanred, Kanred x 38 and 38 x San Martín. The crosses Favorito x 39 M.A., Mamouth x 38 and Ardito x Excelsior were inferior and will be discarded.
Special mention is given of the following hybrids : 38 x San Martín No. 77, a new hybrid of H 51 x 38, H 58 (Marquis x Vencedor), H 59 (Marquis x Sin Rival) and several other hybrids from the same cross, and H 33 selection No. 113 (Ardito x Vencedor).
The data on the determinations of the different components of quality are tabulated.

946. 633.11:575(82)
D'André, H. 633.11:664.641.016(82)
Aptitudes y cualidades industriales de los trigos de " pedigree " de gran cultivo y de nuevas variedades en experimentación, en el año agrícola 1931–32. (**Suitability and industrial qualities of the pedigree wheats in cultivation and of new varieties under trial in 1931–1932**).
Bol. Minist. Agric. B. Aires 1933 : **34** : 3–38.
A study for the 1932 harvest, on the lines of the work described in the preceding abstract, of 346 specimens of wheat, covering 94 varieties, of which 24 were hybrids not yet released. This time the hybrids of (Bx R–C) x Kanred, San Martín x Kanred, Kanred x Lin Calel, Vencedor x Lin Calel and Kanred x San Martín gave the best results, in the order given. The new selection, K.0183, now named " Guatraché," also appeared among the better wheats, and a hybrid of Record x Ardito, together with H 41 from San Martín x Vencedor gave high values, though only one sample of each was tested.

947. Bassova, A. P. 633.11:575"793"
(**Early wheats of different countries as initial material for breeding.**)
Bull. Appl. Bot. Leningrad 1933 : Ser. A (7) : 117–28.
A valuable means of avoiding loss from drought is to cultivate early varieties, and a world collection of early wheats has been made with this object, embracing 192 specimens of spring wheat. The wheats of India, with their coarse, hard, non-shattering ears and stiff straw of medium height, are particularly adapted to mechanized farming and are also very early and drought-resistant, with grain of high quality. Their defects are low yield, poor germination and insufficient tillering but they are of great value as breeding material.
The wheats of Afghanistan are of a similar type but defective in a greater number of respects than the Indian wheats and are not so strongly recommended.
The wheats grown and bred in Australia, Canada and South Africa, having Indian wheats in their parentage, are also highly suited. The variety Birdproof from South Africa is of especial interest.
As regards *durum* wheats, those of Syria and Palestine are of great value in respect of earliness, disease resistance, strength of straw and type of grain, especially the wheats of Khoran.
A list is given of all the early wheats in the collection, grouped according to countries, with brief indications of their general characteristics, earliness, 1,000 grain weight and yield. A further table gives the wheats recommended as parents in breeding with various different objects in view.

948. Krasnosselsky-Maximov, T. A., Brovzina, V. L. and Kotelnikova, O. L. 633.11:575"793"
(**Determination of winter and summer forms of cereals in laboratory conditions.**)
Bull. Appl. Bot. Leningrad 1933 : Ser. 3 (3) : 165–70.
Experiments and illustrations are presented which shew that the growing points at an early stage differ in winter and spring varieties grown under continuous illumination. Those of the spring varieties are lobed, elongating and obviously developing, those of winter varieties rounded and in a state of rest. Using a 400 candle-power bulb it is possible to differentiate between *durum* wheats 20 days, soft wheats 15–16 days, rye 10 days and oats 7 days after germination. The " alternative " wheats and oats behaved intermediately. Moreover there are indications that the method also makes it possible to distinguish between early and late varieties ; a tentative classification of a number of Argentine wheats from a cross of winter by spring forms was confirmed by their later behaviour.

949. Rosenstiel, K. v. 633.11:575
Weizenzüchtung. (**Wheat breeding.**)
Naturwissenschaften 1934 : **22** : 274–76.
The most important problem for wheat breeders in Germany is the production of a wheat which will yield well on poor soils and so replace rye to a great extent, leaving the better soils

for sugar beet, and oil and fibre plants. Such wheat must also be very hardy and resistant to drought and work with these aims in view is in progress at the Kaiser Wilhelm Institute in Müncheberg.
Still further progress in breeding for improved baking quality is necessary and the methods of Berliner and Pelshenke for testing baking quality on small amounts of material will facilitate the work.

950 STEWART, G. 633.11:575.11
Miscellaneous genetic data from wheat crosses.
J. Amer. Soc. Agron. 1934 : **26** : 249–50.
Isolated data on the following wheat crosses made primarily to obtain superior economic strains are presented :—Hard Federation x (Sevier x Dicklow) F_{22}, (Sevier x Dicklow) G–149 x Hard Federation, Hybrid 128 x Sevier, Ridit x Sevier 59, Turkey x Federation, Ridit x Turkey 989 . The work unfortunately could not be completed.

951. BARULINA, H. 633.11:575.113.4:581.49
(Comparative genetic study of the species of *Triticum*. I. Inheritance of the ligule in wheat species with different chromosome numbers : *T. vulgare* Vill., *T. compactum* Host., *T. durum* Desf.)
Bull. Appl. Bot. Leningrad 1933 : Ser. 2 (5) : 127–65.
The botanical significance of the ligule is briefly discussed ; one character of importance which has been shewn to be correlated with the liguleless forms is a susceptibility to attack by the fly *Adia genitalis* Schnabl.
Liguleless forms are thought to have originated by recessive mutation and their appearance in inbred populations of maize and rye supports this view.
Nearly all the known liguleless forms of *Triticum vulgare* were crossed with liguled forms of the most varied origin, in 41 different combinations. In addition six similar crosses of *T. durum* varieties were made.
In all cases the ligule was fully developed in F_1. In F_2 the proportion of liguled to liguleless was 15 : 1 in the *T. vulgare* and *T. compactum* group, but 3 : 1 in the *T. durum* crosses. The same relationships were observed in a second sowing of the F_2 in the following year and were confirmed by the F_3 results. The degree of development of the ligule in the liguled hybrids varied but no clear genetic grouping could be made. The data shewing the behaviour of the various F_2 types in F_3 are tabulated.
It is suggested that the bifactorial inheritance of the character in the soft wheats is due to their polyploidy.

952. LAUMONT, P. 633.11:575.127.5:633.11 *Aegilops*
Contribution à l'étude des hybrides naturels de Blé et d'Égylope. **(A contribution to the study of natural hybrids of wheat and *Aegilops*.)**
Bull. Soc. Hist. Nat. Afr. 1933 : **24** : 179–83.
Individual descriptions are given of the seven lots of plants that developed from 8 fertile, black, cylindrical ears of *Ae. triticoides* found in 1931 among a population of *Ae. ovata* growing in a field where the previous year's crop had been a hard wheat. All 7 groups differed clearly in pubescence; coloration and fertility of the ears.
Though a considerable number of *Aegilops* characteristics were found in these natural hybrids and the artificial hybrid progeny obtained from the *Ae. triuncialis* x *T. durum* cross made in 1929 (see " Plant Breeding Abstracts," Vol. III, Abst. 622), nevertheless the two progenies differed considerably from each other owing to their having originated from two very unlike forms of *Aegilops, viz., Ae. ovata* and *Ae. triuncialis*.
A few of the F_3 generation types are described and attention is drawn to what is perhaps the first record of a fertile second generation derived from a natural *Ae. triticoides* and in process of segregation.

953. LAUMONT, P. 633.11:575.127.5:633.11 *Aegilops*
Observations sur l'apparition de quelques formes " tendroides " dans la descendance (F_4) de l'hybride *Aegilops triuncialis* L.♀ x *Triticum durum* Desf. ♂. **(Observations on the occurrence of a number of " tendroid " forms in the progeny (F_4) of the Hybrid *Aegilops triuncilais* L. ♀ x *Triticum durum* Desf. ♂.)**
Bull. Soc. Hist. Nat. Afr. 1933 : **25** : 184–97.

In the F_3 from an artificial *Ae. triuncialis* L. x *T. durum* Desf. cross a number of forms resembling the soft wheats were examined (see " Plant Breeding Abstracts," Vol. III, Abst. 622). Some of them were completely sterile, others remarkably fertile, *e.g.*, lines No. 7·944–b (with 184 grains) and 7·949–G (with 82 grains). The progeny of these two lines contained numerous " tendroid " individuals closely resembling soft wheat in length, size and habit of straw, in the general form of ears, glumes, etc. These tendroids might be useful as initial material in breeding for short straw, high tillering capacity, resistance to drought.
The appearance of these tendroid lines would seem to confirm the various hypotheses on the probable origin of the soft wheat series of wheats from a cross between some of the hard wheats and some *Aegilops* species.

954. 633.11:575.127.5:633.14:576.356.5
KAGAWA, F. and CHIZAKI, Y. 633.11 *Aegilops*:575.127.5:633.14:576.356.5
Cytological studies in genus hybrids of some cereals and a related plant.
Bull. Utsonomiya Agric. Coll. 1934 : No. 5 : 53–65.

Meiosis is described first in a hybrid *Triticum durum* (n = 14) x *Secale cereale* (n = 7). From 0 to 5 bivalents were observed. Diploid pollen grains were produced by inclusion of all chromosomes in one cell at the first division and by formation of restitution nuclei. This should make it possible for amphidiploid hybrids to be produced.
In *Aegilops triuncialis* (n = 14) x *Secale cereale* (n = 7) 1–7 bivalents and 0–3 trivalents were observed. Though autosyndesis between the chromosomes of *Ae. triuncialis* is the prevalent form of union therefore, yet a certain amount of allosyndesis is evidently possible. This was also indicated by observation of the behaviour of the chromosomes, most of the rye chromosomes being distinguishable from the *Aegilops* chromosomes by their larger size.
Dyad pollen grains were occasionally produced.

955. KATTERMANN, G. 633.11:575.127.5:633.14:576.354.4
Zytologische Notiz über Weizen-Roggen-Bastarde. **(Cytological notes on wheat-rye hybrids.)**
Z. Züchtung 1934 : A **19** : 183–94.

Crosses were made between a number of varieties of *Triticum vulgare* and one of *T. durum* with varieties of *Secale cereale* and hybrids were obtained from three crosses. Backcrosses were made to the parents and three plants, one from a rye back-cross and two from a wheat back-cross, were cytologically examined.
In the first case the number of bivalents ranged from 5–12 and 9 were most frequently observed. A variable number of rings and end-to-end bivalents were also seen. The presence of 12 bivalents is of interest as it suggests autosyndesis of the wheat chromosomes.
As a rule, during the anaphase of the first reduction division, most of the univalents divide longitudinally after the separation of the bivalents. Some univalents are included whole in the dyad nucleus. It is striking how few karyomeres are formed. Irregularities in mitosis were also observed in some of the somatic tissues.
In the plant with 49 2n chromosomes from the backcross with the wheat parent there was a great variety of combinations. As many as 22 bivalents were observed as well as 2 quadrivalents and 1 trivalent.

It was noticeable that at metaphase the bivalents were arranged at the centre of the equatorial plane and the univalents towards the periphery. The chromosome number of the plant is explained by assuming an unreduced number in the egg cell and allosyndesis between wheat and rye chromosomes is suggested to account for the number of bivalents.
The third plant, from a wheat backcross, had 39 2n chromosomes and shewed 12–14 bivalents and it is assumed that the egg cell had 18 chromosomes.

956. FRIEDBERG, L. 633.11:576.16:578.088
Action de l'acide phénique et de la potasse alcoolique sur les blés. (**Action of carbolic acid and alcoholic potash on types of wheat.**)
Sélectionneur 1933 : **2** : Fasc. 1 : 20–29.
Having referred to the various methods that have been suggested for identifying varieties of wheat, a method based on the colour reaction of the grain on treatment with carbolic acid is described and the results obtained with different varieties tabulated.
The reaction is stated to be a stable genetic character and can be used to identify pure lines or fixed varieties but not segregating hybrids.
By a further elaboration of the technique a similar and even clearer reaction, since intermediate reaction classes seldom occur, has been obtained from the ear (excluding the grain).

957. 633.11 *T. monococcum*:576.356.52:576.354.5
KIHARA, H. and KATAYAMA, Y.
(**Maturation divisions in haploid *Triticum monococcum*.**)
Agric. and Hort. Japan, 1933 : **8** (12) : Pp. 17.
A further study of haploidy in *T. monococcum* (see "Plant Breeding Abstracts," Vol. III, Abst. 201).
During prophase of the first maturation division no syndesis is found to occur. Diakinesis is remarkable for an end-to-end association of the univalents, closed rings and various resultant constellations being formed. The explanation suggested for this end-to-end union of the univalents is the action of "axial forces" and only in one instance is the end-to-end formation of the pair of chromosomes attributed to a slight duplication.
The distribution of the univalents in anaphase of the first maturation division and the frequency of the various modes of distribution are discussed.
Microscopic investigation of the pollen grains shewed that about 5 per thousand are externally sound, the remainder greatly shrunken and partly dried up.
Of three grains obtained from a haploid plant, only one germinated and gave a normal diploid plant.

958. SUNESON, C. A. and KIESSELBACH, T. A. 633.11–1.531.27
Differential varietal responses of winter wheat to time of planting.
J. Amer. Soc. Agron. 1934 : **26** : 294–96.
Plantings on the 26th September, 6th October and 15th October of 20 varieties or selections of winter wheat, differing in Hessian fly resistance and winterhardiness, revealed that while groups of varieties reacted similarly to the variable factors of planting date, differential varietal responses were very pronounced. Since changes in the degree of expression of Hessian fly prevalence, winter killing and other environmental factors influencing the wheat crop vary with time of sowing, the introduction of duplicate plantings at several dates should be a valuable adjunct to the technique of advanced testing.

959. ZIMMERMANN, J. G. 633.11–2.183:581.46
Anatomische und morphologische Untersuchungen über die Brüchigkeit der Ährenspindel in der Gattung *Triticum*. (**Anatomical and morphological investigations on the brittleness of the rachis in the genus *Triticum*.**)
Z. Züchtung 1934 : A **19** : 164–82.
The rachis may break either at the base of the rachis internodes, *i.e.*, above the spikelets as in *T. dicoccum*, or directly below the spikelets as in *T. Spelta* or in both ways. The anatomical

structure of the tissues of the rachis was investigated in a number of forms of *Aegilops* and *Triticum* and some speltoid and vulgoid forms. Differentiation of the peripheral sclerenchyma of the rachis is responsible for the breakage and the variations in each type are described in detail. In a discussion of the results of the anatomical and morphological data it is shewn that there is a definite relationship in these respects between the two genera *Aegilops* and *Triticum*, but there is no support for Percival's hypothesis that the hexaploid wheats have originated from a cross between *Aegilops ovata* or *Ae. speltoides* with wild wheat. The suggestion is made that hexaploid wheats have arisen from the tetraploids by polyploidy.

960. 633.11–2.451.3–1.521.6
NIEVES, R. 632.451.3:576.16
La caries o carbón hediondo del trigo. (**Bunt or stinking smut of wheat.**)
Bol. Minist. Agric. B. Aires 1933: **32**: 397–411.
A general account of the fungus.
Artificial infections of great intensity with a local strain of the fungus carried out on a series of Argentine wheats shewed them all to be insufficiently resistant. The tests were extended to varieties obtained from all over the world. Certain of the local hybrids still under test, as well as various imported varieties, shewed promising degrees of resistance.
Extensive observations on the fungus disclosed the existence of two physiological forms of *Tilletia levis* and six of *T. tritici*, differing markedly in virulence.

961. SUTHERLAND, J. L. and JODON, N. E. 633.11–2.451.3–1.521.6
Resistance of wheat varieties to bunt at Moccasin, Montana, and North Platte, Nebraska.
J. Amer. Soc. Agron. 1934: **26**: 296–306.
A series of tests lasting 4 years and 6 years, carried out at North Platte and Moccasin Experiment Stations to determine the bunt reaction (*Tilletia* sp.) of large numbers of varieties and strains of winter wheat, shewed that a large number of them were highly resistant.
In the author's opinion the results (which are shewn in tabulated form) suggested that bunt reaction data for a single year are a fairly reliable criterion of the expectation in any other year and for either of the districts mentioned, provided good infection is secured and no new physiological forms of bunt appear. It also seems probable that bunt resistance tests need be of relatively short duration especially for susceptible varieties and that the results for any one location in the Great Plains may be rather widely applied.

962. JAKUBZINER, M. 633.11 *T. Timopheevi*–2.452–1.521.6
(**The wheat of West Georgia as breeding material.**)
Bull. Appl. Bot. Leningrad 1933: Ser. A (8): 220–21.
Triticum Timopheevi in 1932-33 proved resistant to *Puccinia triticina*, *P. glumarum* and practically resistant to *P. graminis*, its resistance being in excess of that of any other known wheat. An account in detail will appear later.

963. 633.11–2.452–1.521.6:575.11
633.11–2.451.3–1.521.6:575.11
633.11–2,3–1.521.6:575.11
AUSEMUS, E. R. 633.11–2–1.521.6:575.116
Correlated inheritance of reaction to diseases and of certain botanical characters in triangular wheat crosses.
J. Agric. Res. 1934: **48**: 31–57.
The inheritance of reaction to stem rust (*Puccinia graminis*) bunt (*Tilletia tritici*) and black chaff (*Bacterium translucens undulosum*) and of awnedness and colour of coleoptile was investigated in triangle crosses of the spring wheats Hope, Marquillo and Supreme.

In the Hope x Marquillo cross inheritance of the mature plant reaction to stem rust appeared to depend on three or more factors. The mature plant semi-resistance of Marquillo was conditioned by factors that were not allelomorphic with factors for the mature plant resistance of the Hope type. In the Hope x Supreme cross mature plant resistance seemed to be due to at least two factors ; while in the Marquillo x Supreme cross apparently at least three genetic factors underlie the mature plant resistance and susceptibility to stem rust.
The seedling reaction to stem rust, form 36, in F_3 lines of Hope x Marquillo and Hope x Supreme gave a ratio of 1 resistant : 2 segregating : 1 susceptible, indicating a monofactorial basis for resistance. All F_3 lines of Marquillo x Supreme were susceptible.
The only deduction that could be made from the bunt resistance investigations was that the greater the susceptibility of one or both parents the greater the tendency of the hybrids towards susceptibility ; but the number of genetic factors involved could not be ascertained.
Segregation for the black chaff reaction occurred in the Hope x Marquillo and Hope x Supreme but not in Marquillo x Supreme.
The segregation for awnedness indicated the action of a single genetic factor both in the Hope x Marquillo cross and in the Marquillo x Supreme cross, and of two genetic factors in the Hope x Supreme cross.
Both crosses with Hope as a parent shewed a single factor difference for purple and green coleoptile colour.
A tendency was noted to linkage or association of mature plant reaction to stem rust and seedling reaction in the Hope x Marquillo cross and of mature plant reaction to stem rust and reaction to black chaff in the crosses of Hope with Marquillo and Supreme.
Observations of various hybrids indicated that the resistance of Hope to stem rust did not appear to be due to stomatal behaviour.
The paper includes a survey of previous work on disease resistance, represented by a bibliography of 43 papers.

964. 633.11–2.452–1.521.6:575.11

Stakman, E. C. and Bamberg, R. H. 633.11–2.3–1.521.6:575.11
Hayes, H. K., Ausemus, E. R., 633.11–2.451.3–1.521.6:575.11
633.11–2–1.521.6:575.116

Correlated inheritance of reaction to stem rust, leaf rust, bunt, and black chaff in spring-wheat crosses.

J. Agric. Res. 1934 : **48** : 59–66.

These experiments were made to ascertain the extent of genetic linkage or association of the reactions of various spring wheats to stem rust (*Puccinia graminis*), leaf rust (*P. triticina*), bunt (*Tilletia* sp.) and black chaff (*Bacterium translucens undulosum*). The plant material consisted of the F_3 progeny of crosses between H–44 with Double Cross No. II–21–28 and Kota x Marquis No. II–19–167 respectively.
Inheritance of the mature plant stem-rust resistance of the H–44 parent seemed to be determined by a single genetic factor difference, while the moderate plant resistance of Nos. II–19–167 and II–21–28 appeared to be dependent on factors that were not allelomorphic to those determining mature plant resistance of the H–44 type. There was some indication that more than a single factor pair underlies the stem rust resistance of mature plants of the H–35 parent in the crosses with Marquis.
The number of factor pairs responsible for segregation of reaction to leaf rust, bunt and black chaff could not be determined, though a considerable number of resistant types were obtained in all cases.
The inheritance of reaction to the following combinations of diseases appeared to be independent : stem rust and bunt, leaf rust and bunt, leaf rust and black chaff, and black chaff and bunt. There seemed to be linkage in the inheritance of reaction to stem rust and leaf rust and of reaction to stem rust and black chaff. A possibility is thought to exist of combining the mature plant resistance to stem rust of the H–44 type with the black chaff resistance of many varieties and hybrids of common wheat.

965. BAYFIELD, E. G. 633.11:664.641.016
Soft winter wheat studies. II. Evaluating experimentally milled flours with the aid of viscosity, fermentation, and baking tests.
Cereal Chem. 1934 : **11** : 121–40.
A study of 10 varieties of wheats grown at 10 different locations in Ohio shewed that variety is much less important than environment as a factor causing variation in quality.
The relative value of the baking, viscosity and fermentation tests used to determine the quality of the 10 wheats was estimated. Full details of the various quality correlations found are given. Among the varieties tending to vary considerably were Michigan Amber and Nabob, both of which are regarded as possibly heterozygous for the characters that go to make up " quality " ; the importance in breeding work of selecting for quality and not for morphological characters only is pointed out.

966. PELSHENKE, P. 633.11:664.641.016
Die Qualität der Inlandsweizensorten. (**The quality of our home wheat varieties.**)
Mühlenlaborat. Lpz. 1934 : **4** : 1–8.
In view of the fact that Germany is now practically self supporting as regards wheat production, the problem of combining and maintaining good quality with high yields under German conditions is receiving full attention. Improvement of the quality of German wheat should be based on improved gluten content and quality. The performance (based on estimations of these two factors) is presented in tabulated form for winter and spring varieties grown in Germany during 1931–33 and a corresponding table shews their distribution.

967. ALABOUVETTE, L. 633.11:664.641.016(44)
La qualité des blés cultivés en France et le problème de son amélioration. (**The quality of the wheats cultivated in France and the problem of their improvement.**)
Sélectionneur 1933 : **2** : Fasc. 4 : 5–44.
In this paper, in which much of the literature referred to has already been reviewed in " Plant Breeding Abstracts," the following subjects are discussed :—The requirements of French millers and bakers with regard to wheat defects in French wheats and how far they can be remedied and finally the influence of wheat quality in lowering the quality of bread. Sections are included on the characteristics of a good wheat for milling and baking ; the quality of French wheats as determined by the extensimeter, various discrepancies in the results obtained being considered ; the factors determining gluten quality such as variety, local conditions, the mode of cultivation and the influence of the preceding crop and manures.
Three methods of improving the quality of French wheats are mentioned and in part elaborated and weighed, *viz.* : (1) a return to the old F_2 wheats reputed of good quality ; (2) the introduction of suitable foreign wheats ; (3) the production of new types by hybridization. In touching on the inheritance of grain quality the parentage of a considerable number of French wheats is given and reproduced in diagrammatic form.
In the author's opinion the economic factor is decisive and until foreign wheats are entirely excluded from France the problem of combining quality and quantity in French wheats will not be solved.

968. ALBIZZATI, C. 633.11:664.641.016(82)
Estudio comparativo entre nuestros trigos de " pedigree " y los tipos de exportacion en el primer cuatrimestre de 1933. (**Comparative study of our pedigree wheats and the export types in the first four months of the year 1933.**)
Bol. Minist. Agric. B. Aires 1933 : **32** : 253–59.
Data of the quality of the local wheats determined by the Saunders test are given, shewing that the wheats exported from the country contain a considerable quantity of grain of inferior

quality. Wheats of first quality can be and are grown in the country, as shewn by some of the samples, and a plea is made for legislation prohibiting the cultivation of varieties of inferior quality.

969. D'André, H. 633.11:664.641.061:578.081
Apreciación de la " aptitud panadera " de los trigos por la medición de las propiedades mecanicas de sus pastas. (**Determination of the " baking quality " of wheats by measuring the mechanical properties of their flour.**)
Bol. Minist. Agric. B. Aires 1933 : **32** : 23–34.
The extensimeter and farinograph are described and their applicability briefly discussed.

970. 633.11 *Aegilops*:575.127.5:633.11
633.11 *Aegilops*:575.127.5:633.14
Buchinger, A. 575.127.5:575.115
Zur Genetik der *Aegilops*–Weizen– und *Aegilops*–Roggen–Bastarde. (**On the genetics of *Aegilops* x wheat and *Aegilops* x rye hybrids.**)
Genetica 1933 : **15** : 299–342.
For successful species crosses the physiological condition of the parent plants which is determined primarily by the degree of vitality and osmotic pressure is of considerable importance, since merely slight differences in osmotic pressure and the tendency to ready hybridization can be taken to be related to sexual affinity, thus offering a simple and reliable basis of selection. This factor then as well as similarity of age and other recognized criteria were taken into account in making the crosses *Aegilops variabilis* Eig. var. *typica* x *Triticum vulgare muticum* var. *miltura* Al. and *Aegilops variabilis* Eig. var. *typica* x *Secale cereale* L., the F_1 generation of which is described in detail.
Particulars are given of the technique of pollination which gave 100 per cent successes in 24 crosses.
A large number of characteristics were studied and the results are conveniently tabulated. Comparison of the influence of the parents in different combinations disclosed the following relationships in plant material produced under identical conditions and at the same time :— Wheat had a much stronger influence than rye upon *Aegilops*. Moreover, in spite of the relatively wide differences between the male parents both hybrids closely resembled each other in essential characters, *e.g.*, number of spikelets per ear, and in some instances even were exactly equal. The mother plant (*Aegilops*) proved dominant in 11 out of 28 or 30 characteristics considered in the two crosses respectively. From the behaviour of the male parents it was evident that a certain character was not dominant under all conditions but that the particular species used as parents and possibly also which species was chosen as male and which as female were important factors in determining dominance.
Reversibility or inconstancy of dominance in the characters of intergeneric crosses was thus demonstrated.

971. 633.11.0014(49.2)
633.16.0014(49.2)
Broekema, C. 633.14.0014(49.2)
Rassenkeuze winterrassen 1933. (**Selected winter varieties 1933.**)
Inst. Plantenveredeling, Wageningen 1933 : No. 33/50 : Pp. 4.
A crop report supplementing the tenth list of races of seed crops with information on the field tests in 1932/33 on winter wheat, winter barley and winter rye.

OATS 633.13

972. Åkerberg, E. 633.13 Bambu
Weibulls Original Bambuhavre. Ny, mycket tidig, avkastningsrik vithavre-sort med utmärkt kvalitet. (**Weibull's original Bambu oats. A new, early, high-yielding, white oat variety of exceptional quality.**)
Weibulls Årsbok 1934 : **29** : 18–19.
Bambu was the result of a cross between two numbered varieties raised at Weibullsholm. It

has yielded practically the same as Arla during the experiments. In quality Bambu represents a great advance, it has a hectolitre weight 1–2 kg. higher than Arla, its 1,000 grain weight is somewhat lower than Seger and the grain content is about that of Arla. The grains are plump and of a fine white colour.
Bambu has especially stiff straw, stiffer than that of Arla. Some observations have shewn that Bambu oats are relatively resistant to grey spot.

973. COFFMAN, F. A. and DAVIS, L. L. 633.13:575.125
Heterosis or hybrid vigor in oats.
J. Amer. Soc. Agron. 1934 : **26** : 318–27.
In these crosses of a number of varieties of oats increases above the larger of the two parents were regarded as evidence of heterosis.
In one cross the seed size (as estimated by weight) was increased directly in the female parent in the F_1 generation. In plant height and panicle length the F_1 usually exceeded the parental means and in one cross the larger parent.
Oat hybrids usually produce fewer culms than their parents, though crosses involving Victoria, a heavy tillering variety, usually exceeded it in the number of culms.
The F_1 plants had usually a higher total plant weight and weight of straw and grain and in some crosses exceeded the larger parent.
Increased earliness, associated with reduced plant size often occurs in F_1 hybrid oats, but in the present experiment some hybrids gave not only an increased yield of grain to straw but an actually higher yield of grain, thus indicating heightened functional efficiency of the hybrids. Heterosis may be observed in a few plant parts in some crosses and in many parts in others.

974. STANTON, T. R., MURPHY, H. C., 633.13–2.451.2–1.521.6
COFFMAN, F. A. and HUMPHREY, H. B. 633.13–2.452–1.521.6
Development of oats resistant to smuts and rusts.
Phytopathology 1934 : **24** : 165–67. (Abst.)
From the cross Victoria x Richland a number of oat selections have been isolated that are resistant to the three diseases, smut, crown rust and stem rust combined. The breeding and selection work is described. Their adaptation and yielding capacity have still to be determined.

RYE 633.14

975. PESOLA, V. A. 633.14(47.1)
Tärkeimmät ruislaatumme maatalouskoelaitoksen kasvinjalostusosaston Jokioissa suorittamien kokeiden valossa. (**The most important rye varieties in Finland based on comparative cultural experiments of the Plant Breeding Division of the State Research Institute, Jokioinen.**)
Valtion Maatalouskoetoiminnan Tiedonantoja, Helsinki 1934 : No. 68 : Pp. 20.
Trials of a number of Finnish and foreign pedigree and land varieties of rye are described. Among the Finnish varieties Toivo, Härmä and Oiva and the Estonian Sangaste rye were superior to the medium land sorts, whilst Vihantilainen representing the best land types can stand comparison with the high bred varieties.

976. BUCHINGER, A. 633.14:575:576.341
Praktische Saugkraftzüchtung. (**Practical breeding on the basis of osmotic pressure.**)
Die Landeskultur 1934 : No. 3 : Pp. 3.
The material for these experiments consisted of a population derived from "Melker" rye that had been subjected for some years to mass ear selection. One third of this population was rejected on the basis of morphological characters and the osmotic pressure of half of the remainder was determined by cutting the ears in two and testing one half and retaining the remaining half as control. The individual plants of the selected progenies from the various ears were then tested for osmotic pressure and yield and quality against the controls as before. While these progeny tests were continued, records were kept of the pedigrees and performance.

In selection and testing, as many characters as possible were taken into consideration in the initial stages but later with practised observers osmotic pressure is almost solely considered; and according to its value in any particular case a final selection is possible at an early stage in the breeding programme, and a saving of 2 years is effected by sowing control and selected grain simultaneously for comparison.
The author claims that the increases of 21.8 per cent and 32.5 per cent of grain and straw respectively from the selected rye as compared with the original variety are due to the new method of selection and he states that high osmotic pressure is a heritable character which is positively correlated with other valuable qualities and that this holds for individuals within a variety and for the lines of a population and especially in local varieties.
The method is inexpensive and labour saving, requires half the time demanded for a similar breeding experiment on the ordinary lines, and finally is applicable to various types of initial material and to numerous forms of crosses.

977. Ossent, H. P. 633.14:575
Roggenzüchtung. **(Rye breeding.)**
Naturwissenschaften 1934: **22**: 271–74.
The production of self-fertile rye is an important factor in rye breeding and with this end in view selection of Original Petkuser winter rye was begun in 1929. The results have been so satisfactory that by 1933 77·36 per cent of the plants gave a set of more than 20 grains per ear, some giving as many as 40–50 grains. Further selection was therefore made on these strains for grain size and plants shewing the effects of inbreeding were discarded.
Combinations are also to be made with other strains of selfed rye from which it is hoped to obtain the long desired high-yielding, short strawed rye. The results shew that it is possible to produce a self-fertile rye which is completely immune to the bad effects of inbreeding, and the next step is the production of autogamous strains.
Crosses between Petkuser rye and the perennial *Secale montanum anatolicum* to combine the perennial habit with the qualities of cultivated rye are also being made and from the progeny it has been possible to select strains without the brittle rachis and small grains of the wild rye. The dry summer of 1933 has also selected out the drought resistant plants. It is yet to be seen how constant this perennial tendency will remain, but such a perennial rye should be of great value as a fodder plant.

978. Hasegawa, N. 633.14:576.312.32
(A cytological study on the 8-chromosome rye.)
Jap. J. Genet. 1934: **9**: 97–99.
The findings of previous investigators are cited in connexion with the author's observations on *Secale cereale*, from which it was seen that some 8 bivalent chromosomes consist of 7 bivalents of the same size and shape and one small bivalent in which the two chromosomes are joined end-to-end. Moreover it was noted that 7 of the 8 chromosomes were of the same size and shape as those of the ordinary 7 chromosome pollen grain while the supernumerary chromosome was much smaller and sub-terminally constricted to form an oval head and a long arm.
In 8 chromosome pollen grains nuclei the longitudinal halves at first anaphase occasionally pass to the poles later than the rest of the chromosomes. Also at division of the pollen nuclei 2 surplus daughter chromosomes are often found in the reproductive nuclei or may be excluded and disintegrate, from which it is clear that the second generative nucleus has at first a full complement of chromosomes.
Measurements of the chromosomes in some cases were approximately the same as those obtained by Levitsky (see " Plant Breeding Abstracts," Vol. II, Abst. 564).

979. Jung, E. 633.14–2.183
Über Körnerausfall bei Roggen. **(On shattering in rye.)**
Z. Züchtung 1934: A **19**: 153–63.
The amount of shattering in three varieties of rye was determined by letting the ears drop twice from the edge of a table 1 m. high on to a glass plate and calculating the results on the

basis of the number of grains that fell out. This method was found more satisfactory than striking the ears or centrifuging them.
The differences in the behaviour of the three varieties are carefully described.

980. KAZARYAN, S. 633.14:664.641.016
(Milling and baking properties of the varieties of rye.)
Suppl. 55 Bull. Appl. Bot. Leningrad 1933: Pp. 134.
In 1930 an extensive investigation was started on the baking quality of 171 samples of common cultivated varieties of winter rye, embracing 14 Russian and 7 foreign varieties. The method described by Chingo-Chingas for wheat was used throughout.
The first part is devoted to the variation in quality in samples of the same variety grown in different parts of the country, each variety being treated in turn.
The relative merits of the varieties are then discussed on the basis not only of grain quality but of this in conjunction with yield and frost resistance. The observations were made on samples grown in a number of different regions and the samples from each station discussed separately. The yields, 1,000 grain weight, bushel weight, vitreousness, flour extraction, water-absorbing capacity, porosity, volume and shape of loaf and strength are all tabulated. Though not so pronounced as in wheat, unmistakable varietal and environmental differences were observed.
The existence of the following correlations was established: flour extraction and size of grain, with a coefficient of correlation of $+0{\cdot}32\pm0{\cdot}07$; volume of bread and absolute weight of grain, $r = +0{\cdot}41\pm0{\cdot}06$; volume of bread and flour yield, $r = +0{\cdot}22\pm0{\cdot}07$; volume of bread and yielding capacity of variety, inversely, $r = -0{\cdot}22\pm0{\cdot}07$; absolute weight of grain and yielding capacity, inversely, $r = -0{\cdot}26\pm0{\cdot}07$; absolute weight of grain and bushel weight, $r = 0{\cdot}20 \pm 0{\cdot}06$.
Judged on all these characters together, including also resistance to shedding and lodging, and uniform adaptability to a number of different regions, the variety Vyatka was the best, followed by Avant-garde. The foreign varieties proved less successful, though in individual agricultural characters and in quality they were often superior. They are therefore invaluable for hybridization and will supply the local types, adapted to local conditions, with just those characters in which they are at present deficient.

MAIZE 633.15

981. BENL, G. 633.15:575.11
Genanalyse bei *Zea mays* I. **(Gene analysis in *Zea mays* I.)**
Z. Züchtung 1934: A **19**: 235–97.
A survey of the existing data on the factors already identified in maize giving first a list of the factors with their symbols, the part of the plant which they affect, the names of the workers who have identified them and, if known, the chromosome in which they are localized. About 300 genes are so described. The 10 chromosomes are then taken in order and the characteristics of the genes which they contain and their linkages are briefly described and a chromosome map is given in each case.
The genes whose position has not yet been identified are grouped according to the plant character which they affect.
Finally, 18 genes which have not yet received symbols are briefly mentioned.
A list of references covering over 20 pages completes the paper.

982. KEMPTON, J. H. 633.15:575.11
Heritable characters in maize. XLVII. Branched silkless.
J. Hered. 1934: **25**: 28, 29–32.
The character branched silkless (*Bd. bd*) in maize is a heritable recessive character in which the ears are much ramified and without silks. Breeding tests have shewn that the gene Bd, bd causing the condition is distinct from the ramose and the silkless genes. The tassels of branched silkless plants, though abnormal with short thick branches, are not ramified as in the case of the ramose character.

The behaviour of the character in a number of crosses is described and the tassel and ear types produced by interaction of branched silkless and other genes are mentioned and exemplified by illustrations. There were some slight indications of the possibility of linkage between tunicate and branched silkless.

983. WENTZ, J. B. and SMITH, S. N. 633.15:575.116.12
Linkage data on the R-gl chromosome of maize.
Iowa St. Coll. J. Sci. 1934: **8**: 295–301.

A concise presentation of linkage data on the genes Gm_2gm_2, Pg_1pg_1, L_2l_2, L_4l_4, G_1g_1, in the *R–gl* chromosome of maize, collected since the 1930 report of Emerson and his associates. In the main the relative positions of the genes are confirmed, the only marked discrepancy being the absence of linkage between gm_2 and l_2 or l_4 according to the authors' findings. No explanation can at present be offered for this lack of agreement in the relative positions of the genes.

984. 633.15:575.116.4:581.483
EMERSON, R. A. 575.114:575.113:581.162.51
Relation of the differential fertilization genes *Ga*, *ga*, to certain other genes of the *Su-Tu* linkage group of maize.
Genetics 1934: **19**: 137–56.

Experiments of earlier investigators are reported, shewing that the gene acts by producing sterility of *ga* pollen on *Ga* plants, no effect being produced when *Ga* is absent from the female parent.

The present author has made many crosses between different starchy and sugary types, all of which gave normal ratios with 25 per cent sugary, except when using "rice pop," which gives very much reduced percentages of sugary, *viz.*, round about 15 per cent in the F_2 progeny of heterozygous plants. These are evidently of the constitution *GaSu/ga su*, as opposed to *ga Su/ga su* for plants giving normal ratios. The F_3 progenies contain three classes, characterized by low, medium and high proportions of sugary in the percentages 16·0, 24·4 and 36·0. The high sugary is evidently a cross-over class, since the F_4 progeny from these plants continued to give high sugary plants in the same proportions as the proportions of low sugary from the low sugary F_3s. The normal sugary F_3s continued to give normal ratios in the F_4. When crossed with the derivatives containing the *Ga* gene both rice pop (*Ga su*) and its starchy derivatives (*Ga Su*) gave normal ratios.

To test the nature of the action of the gene further, various combinations of heterozygous plants giving high, normal and low sugary percentages were back-crossed with *ga su* and *Ga su* parents. Normal ratios of 50 per cent sugary were produced in all cases except where plants heterozygous for *Ga ga* were used as pollen parents with *Ga su* plants; in this case *Ga Su/ga su* plants gave 30·3 per cent and *Ga su/ga Su* plants 67·8 per cent sugary.

The *Ga ga* gene has no effect on the behaviour of characters in any of the other linkage groups, and is evidently in the *Su* group. The percentage of sugary in the progeny is governed entirely by the recombination percentage if none of the *ga* pollen grains function and by the recombination percentage plus the percentage of functioning *ga* pollen if some of them do function. Previous workers have calculated the recombination percentage of *ga* and *su* as 29, and the percentage of functioning *ga* pollen on *Ga* silks as equal to 2·5 The present author pollinated *Ga* plants with a mixture of *Ga* and *ga* pollen, by which the effect of the crossing-over is eliminated. When this mixed pollen was applied to *ga* plants, over 50 per cent of the kernels were fertilized by *ga* pollen, whereas on the *Ga* plants this percentage was reduced to 0·6 – 9·5, with an average of 4 per cent. Hence about 4 per cent of the *ga* pollen functions on *Ga* plants. On this assumption the recombination percentage is calculated as 27·8.

Comparing the proportions of plants like the parent and the reverse of the parent in the progenies of an equal number of high and low sugary plants with those expected from different percentages of recombination, the recombination percentage was calculated at 30·9. This method is independent of the amount of the functioning *ga* pollen. The assumption that a deviation upwards of 25 per cent in the sugary (*su su*) is accompanied by a corresponding deviation down-

wards in the homozygous starchy (*Su Su*) and vice versa was verified by observing the proportions of homozygous starchy in the progenies of high, normal and low sugary plants and comparing them with those expected on this assumption. Calculation of linkage from the percentages of sugary alone is therefore justified.

On similar lines the recombination percentage between de_1 (defective) and *ga* is shewn to be 35, between de_1 and *ga* 34, and between de_1 and *su* 3·2, based on the data of earlier investigators. Combined with a recombination of 29 per cent for *ga* and *su* the order of the genes is evidently de_1, *Ga*, *su*, de_{16}.

Further experiments involving *ga*, *su* and ts_5 (tassel seed) treated on similar lines shewed recombination percentages of 14 for *su* Ts_5, 20 for *Ga* Ts_5 and 29 for *Ga su*, the genes being in the order *Ga* Ts_5 *su*; and involving *Ga su* and *tu* (tunicate) indicated recombination percentages of 33·5 for *su* and *Tu*, 23 for *Ga* and *su* and 41·4 for *Ga* and *Tu*, the genes being arranged: *Ga su Tu*.

The order of the genes considered and their spacing is therefore considered to be :—

de_1 35 *Ga* 20 Ts_5 14 *su* 3 de_{16} 26 *Tu*

These positions were checked by three-point tests and the coincidence in every case was very nearly unity.

985. JENKINS, M. T. 633.15:575.12:578.081

Methods of estimating the performance of double crosses in corn.

J. Amer. Soc. Agron. 1934: **26**: 199–204.

Four methods of estimating the performance of double crosses were analyzed. Three of these methods utilize information on the single crosses of the parents and probably are the most common methods of estimation. The fourth method which utilizes only the information from the inbred variety crosses of the parents has the important advantage of permitting the inclusion of all lines in the yield comparisons each season. Moreover, investigation shewed that the data from inbred variety crosses are nearly as reliable for estimating the yields of double crosses in a single season as the more extensive data obtained by comparing the necessarily larger number of single crosses.

986. STADLER, L. J. 633.15:576.312.36:537.531

On the genetic nature of induced mutations in plants. II. A haplo-viable deficiency in maize.

Res. Bull. Mo. Agric. Expt. Sta., 1933: No. 204: Pp. 29.

An X-ray variation (designated *X–l*) involving the gene Rr and intermediate in genetic behaviour between typical deficiencies which are eliminated in the gametophyte generation and typical hereditarily transmissible mutations, was found in maize.

The deficiency, which is due to the loss of a terminal segment of chromosome X, is transmitted through the female gametophyte, with somewhat reduced vitality, but not through the male gametophyte. The deficient female gametophytes, like the deficient microspore, completes the essential cell division but lags in development and only a few attain normal function in fertilization and seed development. Ears of plants heterozygous for the defect produce less than $^1/_5$ as many deficient as non-deficient seeds.

The great majority of pollen grains carrying *X–l* are incapable of germination, but this is not attributed to a lethal effect of the deficiency since the microspores are able to accomplish the first steps of germination though no pollen tube is extruded, except possibly in rare instances. Failure to germinate would therefore seem to be due to immaturity. The proportion of germless seeds produced is higher among deficient female gametophytes than among normal gametophytes of the same ears.

Seeds heterozygous for the deficiency are slightly smaller than normal and heterozygous plants are probably somewhat smaller and retarded in flowering.

The question of haplo-viable deficiencies in general, the correct genetic interpretation of their effects and the relation between polyploidy and survival of deficient gametes are discussed.

987. Richey, F. D., Stringfield, G. H. and Sprague, G. F. 633.15–1.557:575.12
The loss in yield that may be expected from planting second generation double-crossed seed corn.
J. Amer. Soc. Agron. 1934: **26**: 196–99.

The results obtained from 10 double crosses of selfed lines of maize exhibited fairly consistent differences in favour of the F_1 generation as compared with the F_2 as regards stand, earliness of silking, dry matter at harvest, marketable ears and yield per acre. The yields per acre for the F_2 were from 5 to 24 per cent less than the F_1 yields of the same crosses, with an average decrease of 15.2 per cent.
The planting of F_2 seed of double crosses is therefore not to be recommended.

988. 633.15–2.3–1.521.6
633.15 Golden Cross Bantam
633.15 Top Cross Bantam
Haenseler, C. M. 633.15 Quaker Hill Top Cross Bantam
New sweet corn varieties resistant to the wilt.
N. J. Hort. Soc. News, 1934: **15**: 579, 582.

Three new hybrids, Golden Cross Bantam, Top Cross Bantam and Quaker Hill Top Cross Bantam included in a test of 28 varieties and strains of sweet corn in 1933 shewed a high degree of resistance to bacterial wilt. These hybrids had stalks 5–6 ft. long and were also very uniform in type, more vigorous than Golden Bantam and yielded a uniform crop of 12-rowed, golden grained ears 8–9 ins. long. They matured 5–10 days later than Golden Bantam and Whipples Yellow.
Golden Cross Bantam gave a slightly higher yield and slightly larger ears than Top Cross Bantam or Quaker Hill Top Cross Bantam.
Two other very promising wilt resisting hybrids, Whipples Cross and Top Cross Whipples, are to be tested in 1934.

989. 633.15–2.482:575.12
Smith, G. M. and Trost, J. F. 633.15–2.482:575.14
***Diplodia* ear rot in inbred and hybrid strains of sweet corn.**
Phytopathology 1934: **24**: 151–57.

A comparison of a number of inbred and hybrid strains of sweet corn and dent corn grown under conditions of natural infection with *Diplodia zeae* revealed (contrary to the usual opinion) that there were apparently no significant differences in the percentages of ear infection in the two kinds of corn.
The range of infection observed among 225 different strains of sweet corn shewed that by selection among selfed lines resistant lines may be obtained.
The percentages of infection in a number of inbred strains of sweet corn and their first generation crosses gave little evidence of any mutual correlation.

BARLEY 633.16

990. Berg, S. O. 633.16 Drake
Weibulls Drakekorn. Ny sort för kärrjordar. (**Weibull's Drake barley. A new variety for swampy soils.**)
Weibulls Årsbok 1934: **29**: 19–20.

This variety, which is a two-rowed barley of the *nutans* type, was bred at Weibullsholm from a cross between Gull barley and an early six-rowed barley from Norrbotten.
When tested with a number of others on marshy ground by the Svenska Mosskulturföreningen, Drake gave the highest and most certain yield.
In hectolitre weight it is only to be compared with Puke and Isaria. With regard to grain size, Drake takes a high place. It ripens relatively early.

991. HERTZMAN, N. 633.16 Maja
Original Majakorn, ny, stråstyv sort, som i avkastning överträffar Kenia. (**Original Maja barley, a new stiff-strawed sort, which surpasses Kenia in yield.**)
Weibulls Årsbok 1934: **29**: 15–17.

Derived from a cross between Gull and Binder, Maja barley has been bred by the Danish breeder Vestergaard of Abed and tested during 1932-1933 at Weibullsholm. In yield it has surpassed all the older varieties, including Kenia. The grains are large, plump and fine with a relatively high hectolitre weight. They have a high starch and low protein content and a specially high germinating capacity and the variety should prove of value as a malting barley. The straw is short, fine and very stiff. In earliness Maja belongs to the same group as Gull, Binder, Opal and Kenia.

992. AUFHAMMER, G. and STEIGERWALD, E. 633.16(43)
Zur Sortenkunde der Wintergerste. Sechsjährige Untersuchungen der Getreidesorten - Registerkommission, Abteilung für Gerstensorten. (**On varieties of winter barley. Six year investigations of the Cereal Varieties Registration Commission, Section for Barley Varieties.**)
Landw. Jb. Bayern 1934: **24**: 1–68.

Altogether more than 40 varieties of German winter barleys obtainable from seedsmen were investigated.

The work is divided into two parts, one dealing with observations on the vegetative development of the plants with regard to morphological and physiological characters and the other with numerical research and the statistical determination of variations which were made mainly on the harvested plants.

The experiments were begun in the autumn of 1927 so that observations were made during six vegetative periods and therefore constitute a reliable source of information of the varieties tested.

It was only possible to deal with those characters which serve to distinguish varieties and variety groups.

For convenience, the period of vegetative growth was divided into four stages, the young stage, from germination to the completion of tillering, the earing stage, the flowering stage and the ripe stage.

In the young stages the growth habit was observed as well as leaf shape, pubescence of the basal leaf sheath and the occurrence of colouring. In the earing and flowering stages leaf formation, nodes, internodes, auricles, ligules, awns and their colouring were investigated and also time of heading. In the ripe stages attention was given to ear shape and position, resistance to lodging and time of maturity.

The grain characters observed were hectolitre weight, 1,000 grain weight, the basal bristle, barbing, germination, ripeness, enzyme content and grain size.

In the second part of the work, the statistics of variation were investigated for the differentiation of morphologically similar forms.

The characters used were number of tillers, culm length, rachis length, number of rachis segments, density and 1,000 grain weight.

Finally the relations between the vegetative observations and the statistics of variation with regard to the similarity between varieties and the advantages of using both methods for investigation are discussed.

993. KUCKUCK, H. 633.16:575
Züchterische und genetische Versuche mit Gerste. (**Breeding and genetical researches with barley.**)
Naturwissenschaften 1934: **22**: 276–78.

A short review of the work in progress since 1928 at Müncheberg.

In breeding for a winter barley which will stand the climate of East Prussia and Pomerania, crosses have been made between high yielding German varieties and winterhardy Rumanian varieties in the hope of combining their desirable qualities.

A hull-less barley is likely to prove a valuable asset not only for animal feeding but also for brewing. Selection is proceeding on the one hand for high protein content for food and on the other for low protein content for brewing.
Large scale selection of populations is being made by the " Ramsch " method, which consists in multiplying the progeny of the crosses from the F_3 onwards for 5–10 years on a field scale and under the conditions for which the new variety is desired. The types unsuited to the conditions are gradually eliminated and by F_8 or later the breeder has a homozygous collection for further tests. A modification of the scheme has been introduced to retain the recessive types which are now grown separately but treated in the same way. The method is not only of practical value but has also a theoretical interest. The question of the value for selection of mixtures of the different morphological and physiological forms, their mutual influence and the dependence of the greater increase of certain types on external conditions should be of importance for the problem of the formation of races and species. The experimental production of mutations is also being investigated.
Species crosses have been made by the author between *Hordeum sativum* (n = 7) and the perennial *H. bulbosum* (n = 14). The F_1 resembles exactly the *bulbosum* male parent, it has 21 chromosomes and it is up to now completely sterile. Whether the hybrid will prove of practical value remains to be seen. Research in this direction is in progress. A genetical analysis of the progeny of crosses between spring and winter barleys has been made and the results are ready for publication.
Victoria barley, a short strawed, dense leaved, and short grained mutant from Bethge barley III, which resembles barleys from the East is being investigated. It has a special phylogenetical interest and would justify an accurate genetical analysis especially by crosses with Japanese forms.

994. Raum, H. 633.16.00.14 (43)
Anbauwert und Ertragseigenschaften deutscher Gerstensorten. (**Cultural value and yielding qualities of the German barley varieties.**)
Züchter 1934 : **6** : 73–83.

The results of variety tests with 13 varieties carried out in 18 different stations over the whole of Germany from 1928 to 1932 when analysed shewed that the yield differences over the whole period between the main varieties were inconsiderable. The varieties which have proved best for favourable and for unfavourable conditions and those best for all-round purposes are indicated. The performance of the varieties in the different years is discussed in respect of weight of grain per ear, tillering, height, yield and strength of straw and time of ripening. The different barley types are dealt with separately.
With respect to grain yield, it is pointed out that the six-rowed spring barleys, which have not been subjected to such rigorous selection as the two-rowed barleys, are less constant in yield. Even the latter are not very substantially superior in yield to unselected strains, which is accounted for by the fact that breeding work has been concentrated on improving malting quality and crossing with high-yielding barleys has been thus excluded.
The most vigorous tillering was displayed by the country barleys, followed by the winter barleys both six-rowed and two-rowed. The spring barleys were all inferior in tillering.
Time of ripening was very much influenced by weather conditions and no variety was invariably earliest or invariably latest. A rough grouping into early and late could be made however. The commercial winter barleys all produced ears and mostly ripened when winter sown. Certain imported barleys, and one emerging from a cross of two spring barleys, proved to be true winter types and failed to ear when spring sown.

MILLETS AND SORGHUMS 633.17

995. Takahashi, N. and Hoshino, T. 633.171:581.162.23
Natural crossing in *Setaria italica* (Beauv.)
Proc. Crop Sci. Soc. Japan 1934 : **6** : 3–19.

The observations cover 3,295 strains from Korea, Japan, Manchuria and North China, and over two million individuals. The distinguishing character used for the determination of natural

crossing is the colouration of stem and leaf sheath. The strains were sown in rows, each non-coloured strain being followed by three coloured strains. The percentage natural crossing, as determined by coloured offspring in the non-coloured strains, was 0·59, but in different strains varied from 0·09 to 1·09. Early and late maturing strains have incomplete flowers and the number of natural crosses in these is low. These natural crosses, carried to the F_2 generation, shewed a bi-factorial basis for colour with ratios of 3 : 1 and 9 : 7. In a series of distance experiments combined with mixed sowings of a coloured with a non-coloured strain, higher figures were obtained up to 2·26 per cent in the mixed sowings. Evidence is adduced to shew that the direction of the wind has an appreciable effect on the amount of natural crossing as has also the nature of the bristles. The differences found, however, are not checked as to their statistical significance. H.M.L.

RICE 633.18

996. SCHULTZ, E. F. 633.18(82)
Notas sobre algunos problemas arroceros. (**Notes on some problems of rice cultivation.**)
Rev. Ind. Agric. Tucumán 1933 : **23** : 199–203.
The author mentions the prevalence of mixtures in the local rice, especially of the wild rice *Oryza rufipogon*, known to cultivators as " coloured rice " (arroz colorado). It is recommended that each cultivator should set apart a certain area for production of carefully selected pure seed.

997. LOVE, H. H. 633.18:575(51)
Directions for rice improvement in China.
University of Nanking, 1933, Pp. 78.
This paper describes in simple language the methods of selection and of testing the yield of strains of rice, which is normally self-fertilized, and is a guide to workers who have no very advanced training. A five year scheme is outlined covering the preliminary selection of heads to an advanced test. The normal precautions which must be taken in such work are described in detail and the system of lay out of the tests, with check plots from which the statistical significance of the differences found may be calculated, is given. H. M. L.

998. KONDO, M. and ISSHIKI, S. 633.18:575.242:581.2
Spontane Entstehung von zwei missgestaltenen Reispflanzen und ihre Vererbungsverhältnisse. (**Spontaneous occurrence of two teratological rice plants and the accompanying inheritance relationships.**)
Ber. Ohara Inst. 1933 : **6** : 1–12.
A more detailed account of the paper previously reviewed (see " Plant Breeding Abstracts," Vol. IV, Abst. 710). In addition a chimaera due to vegetative mutation and exhibiting sterility and twisted leaves in one part and normal function and structure in the other is described.

999. 633.18:576.312.35
GOTOH, K. and OKURA, E. 633.18:576.356.5
A preliminary note on cytological studies of *Oryza*.
J. Soc. Trop. Agric. Japan 1933 : **5** : 363–64.
A brief enumeration of previous work on the chromosome number and instances of haploidy and triploidy in *Oryza sativa* is followed by the findings for three wild species of *Oryza*, *viz.*, *O. cubensis* Ekman, *O. latifolia* Desv. and an undetermined species found growing naturally wild at Tôen, Formosa, and called Oni-ine (*i.e.*, devil's rice). The somatic numbers recorded for these three species are 24, 48 and 24 respectively. All three species differ considerably in appearance. Further investigations are in progress.

1000. NAKAMORI, E. 633.18:576.356.5
On the occurrence of the tetraploid plant of rice *O. sativa* L.
Proc. Imp. Acad. Tokyo 1933 : **9** : 340–41.
In the same year as the occurrence of the triploid (see " Plant Breeding Abstracts," Vol. III, Abst. 434) another aberrant plant occurred in the F_1 of another intervarietal cross Wase-Sinriki

No. 23 x Kyô-Asahi. Root tip counts revealed the presence of 48 chromosomes. While the size of spikelets and of awns is greater even than in the triploid, the number of spikelets and their fertility were reduced, only 27 per cent of the latter giving well-developed grains.

1001. 633.18:578.08

Automatique Brevet Minghetti pour les épreuves du traitement du riz. (**The Minghetti patent automatic machine for testing the results of the manufacturing process in rice.**)

Advert. Pamphlet. Firm, Minghetti, Vercelli, Italy.

The apparatus advertised is compact, works without noise and reproduces in one process the whole treatment which rice undergoes in the factory from the raw product to the white rice of commerce. The machine is recommended as a means of determining rapidly and accurately the effects of manufacture upon rice of any quality and also of discovering any defects that may be present in a particular sample.

1002. NISIKADO, Y., MATSUMOTO, H. and YAMAUTI, K. 633.18–2.42:576.16
632.484:576.16

Reports on the physiological specialization of *Fusarium*. I. On the differentiation of the pathogenecity [*sic*] among the strains of rice—"Bakanae"—fungus.

Ber. Ohara Inst. 1933: **6**: 113–30.

Tests of 36 strains of the so-called "Bakanae" fungus *Lisea Fujikuroi* Saw. of rice on maize revealed marked differentiation in the pathogeneity of the fungus and this form of specialization had apparently little relation to the developmental stage at which the strains of the fungus were isolated or to the locality whence they were obtained. Other Species of *Fusarium* were also tested.

LEGUMINOUS PLANTS 633.3

1003. SENGBUSCH, R. v. 633.3:581.192:575

Die Geschichte der "Süsslupinen." (**The story of the sweet lupins.**)

Naturwissenschaften 1934: **22**: 278–81.

Germany produces large quantities of carbohydrates but insufficient supplies of protein and fat. Lupins which will grow in poor soils and at the same time enrich the ground contain 30–40 per cent of raw protein and 4–6 per cent of fat, but they contain also a high percentage of alkaloids which render their products poisonous and unfit for consumption.

The possibility that alkaloid free lupins might occur as mutations has already been suggested but the difficulty lay in finding a method for the rapid alkaloid determination.

The author has worked out a satisfactory method and from an enormous number of tests has found three forms of *Lupinus luteus* and three of *L. angustifolius* that are free from alkaloid. These sweet lupins are being tested and multiplied. Further work will consist in the selection of types with non-splitting pods, uniformity of ripening and yield, etc. The isolation and cultivation of such desirable types will provide a means for increasing the protein production of Germany.

1004. 633.367:581.6:575
SENGBUSCH, R. v. 633.367:575:578.08

Die Prüfung des Geschmacks und der Giftigkeit von Lupinen und anderen Leguminosen durch Tierversuche unter besonderer Berücksichtigung der züchterisch brauchbaren Methoden. (**Testing the palatability and toxicity of lupins and other legumes by animal experiments, with special reference to methods applicable in breeding work.**)

Züchter 1934: **6**: 62–72.

Suitable techniques and test animals and also the question of rapid diagnosis are outlined for the plant breeder who wishes to test the palatability or toxicity of his plant material. The growth stage of maximum toxicity was also investigated. The experiments relate mainly to lupins but other plants are also mentioned from which the toxic substance may possibly be eliminated by breeding.

1005. LAMPRECHT, H. and HERTZMAN, N. 633.4:575
Kort översikt över Weibullsholms nyare rotfruktsförädlingar. (**A short review of the latest results of breeding root crops at Weibullsholm.**)
Weibulls Årsbok 1934 : **29** : 21–23.
A number of new strains of fodder beets, rutabaga and turnips are described which are improvements on previous sorts.

1006. MAGRUDER, R. 633.41 Ohio Canner
The new " Ohio Canner " table beet.
Bi–m. Ohio Agric. Expt. Sta. 1932 : No. 154 : 18–25.
The early maturing beet root " Ohio Canner " with the round, solid dark red colour that is specially suitable for canning has been bred by the Ohio Agricultural Experiment Station. Its present characteristics and the line of future improvement work on the strain are described.

1007. SCHNEIDER, F. 633.41:576.12:578.08
Beitrag zur Methodik der Unterscheidung von Futterrübensorten. (**A note on the technique of distinguishing varieties of fodder beet.**)
Pflanzenbau 1934 : **10** : 289–96.
As a preliminary to the registration of varieties of fodder beets one-year tests were made with a number of yellow and red cylindrical types of beet with the following results :—
At the seedling stage it was possible to distinguish red and yellow varieties but no further general means of identification within these two groups could be found.
Only rarely was it possible to distinguish the varieties on a morphological basis without performance tests ; moreover the varietal classification of a single individual could not be determined but only the varietal class of a whole stand, and that only when comparison with other stands grown under similar conditions could be made. How far subsequent generations would be distinguishable from the initial stock is unknown.
The characters to be used for identification purposes are shape, colour, tendency to bolting, yield, dry matter content and constitution. Their validity as constant varietalcharacters is briefly examined.

1008. MUNERATI, O. and COSTA, T. 633.41:581.143.32:575.1
Di alcune forme teratologiche della *Beta vulgaris* L. e loro eredità. (**On some teratological forms of *Beta vulgaris* L. and their inheritance.**)
Z. indukt. Abstamm. –u. VererbLehre 1934 : **66** : 463–89.
Various teratological forms are described which have been observed in *Beta vulgaris* during the last twenty years. Some behaved as mutations and in others the abnormalities were not transmitted to the progeny. It appears from these observations that the plasticity of the beet makes it a very suitable object for the most diverse investigations in pure genetics. The sugar content of the abnormal types did not vary much from that of normal plants.

1009. ARTSCHWAGER, E. and STARRETT, R. C. 633.41:581.162.4:581.3
The time factor in fertilization and embryo development in the sugar beet.
J. Agric. Res. 1933 : **47** : 823–43.
In order to elucidate the time factor in fertilization in *Beta vulgaris* L. a study was made of the sequence of the nuclear phenomena in the embryo sac from anthesis until the development of the embryo. Flat Foliage was the variety used and about 3,000 flowers were collected during June in 1931 and 1932.
The morphology of the beet flower, anthesis, the organization of the embryo sac at the time of flowering, pollen size, shape and germination and pollen tube growth are described.

In the course of the study of fertilization and its associated phenomena, it appeared that fertilization takes place approximately 1 day after anthesis and since the pollen germinates as early as 2 hours after the anthers dehisce, the interval between pollen germination and fertilization is theoretically about 20 hours. The possible influence of factors such as the age of the pollen and the open or closed condition of the stigmas on cross-pollination in beet is pointed out. In some beets numerous fertilization stages occurred only 10 hours after anthesis and it is thought that pollen tube growth proceeds more rapidly in some flowers than in others.
The post-fertilization period and the development of the embryo is studied in detail and certain previous views of the author and of other writers on the time element in embryo development are declared to need revision.
Numerous plates and diagrammatic drawings illustrate the paper.

1010. SUN, VON-GEE 633.42:575.2
(A study on the correlation characters in *Brassica*.)
Tech. Bull. Agric. Expt. Sta. Chekiang Univ. 1930: No. 6.
In a random selection of 87 plants of *Brassica* a number of correlations were found to exist between certain of the following characters: number of siliques per plant, yield of seeds per plant, number of primary branches, number of inflorescences per plant, height of plant, average length of internode per plant, distance between the lowest fruiting part and the root crown.

1011. HERTZMAN, N. 633.42–2.411.1–1.521.6:575
Klumprotsjukans bekämpande genom förädling. **(The control of club-root by breeding.)**
Weibulls Årsbok 1934: **29**: 24–27.
Club-root is one of the most prevalent of plant diseases in south and central Sweden and may cause the destruction of practically the whole crop.
The most effective means of control is in breeding resistant strains, and since 1926 the Plant Breeding Station at Weibullsholm has carried out systematic work with this end in view.
The strains are tested in different districts and the results shew considerable variation. Selections have been made of the most resistant strains which are being multiplied for distribution.
The fact that up to now there are no swedes with as good a resistance as that of turnips is because none of the swedes available at the beginning of the breeding work were as resistant as the Naepe turnip.
Crosses have been made between the most resistant swedes and turnips from which it is hoped to obtain resistant swedes.

1012. 633.491 Kalev
AAMISEPP, J. 633.491 Kungla
Jõgeva kartulisordid " Kalev " ja " Kungla." **(" Kalev " and " Kungla " the new potato varieties of the Plant Breeding Station, Jõgeva.)**
Katseasjanduse Nõukogu toimetised Tartus, 1934: Nr. 26. Pp. 36.
Both varieties originated in 1922, from crosses made mainly for high yield, the parents of Kalev being Pepo (♂) x Edzell Blue (♀), and of Kungla, Pepo (♂) x Centifolia (♀). Comparative trials were carried on from 1927 to 1933 in 18 experimental stations and farms in Estonia and in 1932/33 in 5 foreign countries. Deodara and Majestic were taken as standard varieties. In Estonia Deodara is the best universal variety, especially on light soils, when its yield and starch content are high. Majestic outyields Deodara (German varieties) and is considered the best export variety. The two new varieties outyielded Deodara, Kalev by 18 per cent and Kungla by 20·3 per cent. The average yield per ha. of Kalev was 291·5, of Kungla 296·1 and of Deodara 247·1 quintals. The average starch content was 18·02 per cent for Deodara, 15·32 per cent for Kalev, 15·15 per cent for Kungla and 14·62 per cent for Majestic. The starch yield for all varieties is almost the same, except for Majestic, the average yield being for Deodara 43·98, for Kalev 43·30, for Kungla 45·07 and for Majestic 38·04 quintals. The average percentage of large tubers (40 g. and larger) is for Deodara 86·64 per cent, for Kalev 89·30 per cent, for

Kungla 85·09 per cent and for Majestic 87·89 per cent. Both the new varieties are immune to wart disease. Kalev and Deodara prefer light and dry soils, Kungla is suitable only for intensive conditions and requires high humidity, while Majestic is intermediate in its requirements as regards soil and moisture. In general the cooking quality of Kalev grown on light soil is good and mild, on better soils—second quality. The eating qualities of Kungla being mediocre and coarse, the variety is principally suitable for fodder and manufacturing purposes. M.P.

1013. Bushnell, J. 633.491 Late Cobbler
The Late Cobbler, a new variety of potato.
Bi–m. Bull. Ohio Agric. Expt. Sta. 1932: No. 155: 68–70.
The Late Cobbler, which is stated to be a selection from the Irish Cobbler, is very similar to the latter variety in the type of plant and of tuber except that the new type matures about two weeks later and has withstood unfavourable weather conditions much better. In average yield the Late Cobbler has almost equalled Russet Rural. The cooking quality of the new variety is excellent.

1014. Krantz, F. A. and Tolaas, A. G. 633.491 Warba
The Warba—a new early potato.
Minn. Hort. 1933: **61** (7): p. 137.
The Warba obtained from a cross of a selected seedling (No. 4–16) and Bliss Triumph, matures 10–14 days earlier than the Irish Cobbler and 7–10 days earlier than Bliss Triumph. The Warba is also characterized by earliness (being 10–14 days earlier than Bliss Triumph) an erect vigorous growth, high yield, short, round, white tubers with pink eyes and of uniform size in the hill and resistance to mild mosaic.

1015. 633.491(8)
Bukasov, S. M. 633.491:576.16
[The potatoes of South America and their breeding possibilities. (According to data gathered by expeditions of the Institute of Plant Industry to Central and South America.)]
Suppl. 58 Bull. Appl. Bot. Leningrad 1933: Pp. 192.
This monograph constitutes the first really comprehensive account of the new views on the potato and the new South American material. The first chapter outlines the chief events in the introduction of potatoes since the first introductions from Chile 3½ centuries ago. These early potatoes set seed readily, a character which they retained for some time, thus giving rise to a number of varieties by segregation. Further introductions were made in the middle of the nineteenth century but although *Solanum andigenum* and other Peruvian species probably figured in this material no use was made of them by seed firms and breeders. The extremely limited and random nature of the introductions, mainly from Chile, has led to the present position, where at least 300 of our present varieties are derived from Early Rose and nearly as many from Daber.
The systematic study of the potatoes of South America was begun only in 1925 by the Institute of Plant Industry, Leningrad. The monograph gives an account of the places visited by the expeditions and of the material collected, consisting of 13 new cultivated species of potato from the high mountain regions of the Andes, of which one, *S. andigenum*, occupies a very extensive area, and 12 so-called primitive species, with chromosome numbers of 24, 36 or 60. In addition to this large numbers of new wild species have been found.
The species from the Andes are all short-day forms, which fail to develop tubers altogether under long-day conditions. *S. Maglia*, *S. Commersonii* and *S. subtilus* are indifferent to day length where flowering is concerned; the majority flower only in short day. Failure to take into account the light requirements has led to the loss of Peruvian material by many experimenters in the past.
The author uses moveable boxes for artificially controlling the day length of the experimental material. Photoperiod is not a dominant character in hybridization and many hybrids of *S. andigenum* are without its characteristic short-day reaction; the reaction, moreover, is

affected by temperature, the depressing action of long day on tuber development being counteracted by low temperature.

The cytological examination of the material has revealed the existence of polyploid series in the sections *Tuberosa*, *Pinnatisecta*, *Acaulia* and *Conicibaccata*, the sections *Bulbocastana*, *Etuberosa* and *Basarthrum* being represented exclusively by 24 chromosome species. The 24 chromosome members of *Tuberosa* are absent in Mexico, though the 36 chromosome hybrid species are present; the 72 chromosome *Tuberosa* are absent in South America though the 60 chromosome *S. curtilobum* is present.

All the other groups are more primitive than *Tuberosa*, the chromosome number not exceeding 48 in *Conicibaccata* and *Acaulia* and 36 in *Pinnatisecta*. The existence of the entire polyploid series, with the exception of the 5th group with 72 chromosomes, in the cultivated as well as the wild group is perhaps the most remarkable revelation of this material; no less than six cultivated species with 24 chromosomes and five with 36 were found.

The cytological grouping of the species was confirmed on morphological grounds, and later on the grounds of their photoperiodism, resistance to frost, blight, wart, scab and virus, and their time of maturity, period of dormancy of tubers and conditions required for germination of seeds, *e.g.*, fresh seeds of *S. neoantipoviczii* germinated after 14 days in darkness, those of *S. demissum* only in the light and after 38 days. Specific differences were also observed in the starch grains, with a tendency to be smaller in the primitive species; the starch content of the species also varies.

The living material was subjected to detailed examination over a number of years. The various diagnostic characters are discussed in turn, first tuber characters, then leaf and flower characters. The second part is devoted to a survey of the different cultivated species and their varieties, starting with the distribution of the respective species in the several countries under consideration. *S. andigenum*, having the most extensive area, has the greatest number of varieties; endemic varieties are found in Peru, South Peru, Bolivia, Colombia, Argentina, Mexico and Guatemala, each clearly distinguished from the other; the only variety common to two areas is *S. andigenum* Jancko imilla, which occurs both in Bolivia and Peru. The distinctive features of the local forms moreover shew clear segregation on crossing and no intermediate forms appear. The Central Peruvian is taken as the typical and original form.

S. tuberosum, whose distribution is confined to Chiloe and the neighbouring shores, contains a much lower number of varieties. Only two of these, *elegans* (together with *villaroela*) and *bolera* are at all sharply differentiated.

The remaining, primitive species are still lower in number of varieties, most of them being represented by only one or two forms. The 24 chromosome species *S. goniocalyx* and *S. stenotomum* contains hybrids with 36 chromosomes almost indistinguishable from the pure species, a phenomenon never observed in 48 chromosome species.

Botanical descriptions are furnished of the different groups of *S. andigenum* in turn, beginning with the Colombian and Ecuador group, followed by the Central Peru, South Peru, Bolivia and Argentine groups; the forms from Mexico and Guatemala, on account of their greater differentiation from the rest and the uncertainty of their mode of origin or entry, are described last. Next follow the potatoes of Chile, *i.e.*, the varieties of *S. tuberosum*, described on similar lines, with indications in the case of some forms of varieties of modern cultivated European potatoes which they strongly resemble. Certain specimens proved identical with the varieties Early Rose and Up to Date, the majority being, however, quite distinct from the European varieties and worthy of the name of distinct varieties. Most of them have coloured flowers, none is truly early; all except v. *multibaccatum* are sterile or partially sterile. The various early descriptions of the pototoes introduced into Europe are reviewed in the attempt to determine the exact type that these early introductions represented. It is concluded that they really were *S. tuberosum* s.str. By a process of elimination the type of the original potato is defined within certain limits. None of the specimens collected corresponds exactly to this required type. A still further definition of the type of the hypothetical original European potato is attempted by an analysis of the characters of the present European varieties. A scheme of classification of *S. tuberosum* is then suggested, separating the "European" forms from the rest.

The present investigations make clear the distinction between the two main centres of the potato, the Chilean coast, from which our cultivated varieties have arisen, and the high Andes, which contains by far the greatest variety of forms, corresponding to the much greater variety of natural conditions. These latter are particularly varied in Bolivia, which country is also characterized by the greatest number of different varieties and the possession of varieties adapted to the widest range of ecological conditions. Here the rainfall is much less than in the Chilean centre and the types are more adapted to a continental climate. Some of them grow even up to the snow line.

In commenting on the extreme variety of the wild forms, astonishment is expressed not only at the few of these that have been used in breeding but at the entirely random and meagre choice of types by those breeders who have made use of wild species. *S. demissum* for instance, contains a variety of forms, differing in fertility and in a number of the qualities for which this species is valued as a parent. The characters of the different wild species and their promise as parents for breeding are briefly stated.

Indications are also given of the tuber formation, crossing capacity and blight reaction of various species of other sections. Next the primitive cultivated species are discussed, with observations of their value as parents for different purposes, their tuber formation or otherwise in long day, their starch content, vegetative development, frost and blight resistance, flower and fruit formation and capacity to cross with other species. A table is given shewing the degree of variation of these various characters in the wild species, Andean cultivated species and *S. tuberosum*.

A special chapter is devoted to frost resistance, a character found for the first time in the potato and present to varying degrees in a number of species, cultivated and wild, from the Andes and Mexico. Mention is made of the success in crossing *S. aracc papa* with *S. acaule*, which cannot be crossed with *S. tuberosum* and other members of this group. The behaviour of the various species and certain hybrids in the winters 1930–31 and 1931–32 is recorded and reference made to neglected observations of Klotzsch on frost resistance in hybrids of *S. demissum*. *S. acaule*, *S. acaule* x *S. aracc papa* and *S. Juzepczukii* were not affected by a frost of –6°C., *S. demissum* and *S. ajanhuiri* shewed different reactions in different plants, and *S. andigenum* perished entirely except one, var. *Pacus*, which proved resistant.

The success so far obtained in interspecific crossing is discussed in a special chapter. Some crosses of *S. andigenum* with *S. tuberosum* have given yields considerably exceeding the standard cultivated varieties and the starch content of some of them was quite high. The yield of the F_2 sometimes exceeded that of F_1, also in crosses of *S. demissum* x *S. andigenum*. The crossing capacity of the primitive and wild species is described and tabulated, with special reference to the chromosome number. The triploid hybrid *S. acaule* x *S. aracc papa* gave no results, but the hybrid *S. goniocalyx* x *S. Bukasovii* (24 chromosome) crossed both with 24 and 48 chromosome species. The greatest number of successful crosses was obtained with *S. andigenum*, *S. tuberosum* and *S. demissum*, closely followed by *S. Bukasovii* (as pollinator) and also its hybrids; the least number with the triploid species. In some crosses the hybrids were intermediate in character, in others they resembled one of the parents. Unusual chromosome numbers were occasionally observed, *e.g.*, 54 in a seedling from *S. Juzepczukii* (2n = 36).

The present knowledge of the behaviour of the various families of European cultivated potatoes with regard to a number of industrial qualities is outlined, mainly by reference to Rathlef. It is then pointed out that as many as 80 per cent of the varieties of *S. andigenum* are wart-resistant. Some of the Chilean varieties of *S. tuberosum* are also resistant. Resistance to blight is greatest in the Mexican species, some species in sections other than *Tuberosa* being also highly resistant. The genes for high yield are concentrated in Chile, in *S. tuberosum*. Frost resistance is found in the species growing at the greatest elevations, except for *S. Commersonii*, a sub-tropical species.

In addition to *S. tuberosum* and *S. andigenum*, some of the primitive species are of interest to breeders for their relatively high starch content, especially the frost-resistant species *S. ajanhuiri* (used for preparing "chuño"), containing 17 per cent, and *S. curtilobum*, containing up to 20·1 per cent. The native Chilean varieties are characterized by particularly high starch content and certain hybrids of Peruvian species have given higher starch contents than either parent. There are high culinary qualities also as regards flavour in some of the new species.

1016. SCHICK, R. 633.491:575
Kartoffelzüchtung. (**Potato breeding.**)
Naturwissenschaften 1934 : **22** : 283–85.

Potatoes are for Germany the second most important crop plant. Variations in yield due especially to damage by frost and *Phytophthora* mean that a much larger area has to be used for potatoes than should be necessary and the breeding of resistant varieties is therefore a work of considerable importance.

The problem of breeding varieties resistant to *Phytophthora* has been made very much more difficult by the discovery of physiological forms of the organism which attack the hitherto resistant varieties.

With regard to frost resistance a large number of varieties from South America have been collected and tested. Satisfactory results have been given by *Solanum acaule* (resistant to –5°C), S. *demissum*, S. *ajanhuiri* and S. *curtilobum*, all resistant to about –3°.

A method is now needed for large scale testing of the frost resistance of the plants, so that in the following years the other economic characters can be tested and it may be proved whether it is possible to produce a really frost resistant and economically valuable potato.

As all European cultivated potatoes are derived from clones from a limited district in South America, it is probable that by using other varieties from other parts a number of valuable characters might be added to the existing cultivated sorts.

1017. 633.491:575
*BUKASOV, S. M. 633.491(8)
(**Revolution in the breeding of the potato.**)
Lenin Acad. Sci. Inst. Pl. Ind. Leningrad 1933 : Pp. 44.

A review is given of potato breeding in Europe from the introduction of the potato up to the present time ; much emphasis is laid on the poverty of the material as regards new characters, little more having been accomplished than a recombination of the characters already present in the original introductions. The question of blight resistance remains unsolved and the production of early blight-resistant varieties is still the main problem of potato breeding.

New introductions from Chile left the position materially unaltered. The Soviet Expedition to South America in 1925 however revealed the existence of an unexpected wealth of new potatoes and two later expeditions sent with this express object shewed the diversity of new forms to be almost inexhaustible. Further investigations proved that the differences between many of these new forms were not merely varietal but specific, the different species being intersterile and often differing in chromosome number. Potatoes were found growing from the equator to 40°S., from tropical valleys up to the snow line, and the range of adaptability is correspondingly wide, including extremes of earliness and lateness, photoperiod from extreme long to extreme short day, immediate and delayed sprouting, adaptation to extremes of heat and extremes of cold and other widely different ecological conditions.

They set abundant seed, and promising results, including high yield of tubers, have already been obtained by using them in hybridization, though some of the species themselves form no tubers under European conditions. They contain numbers of characters sought in vain in the European cultivated potato and by their use it should be possible to produce varieties resistant to the main potato diseases (particularly blight and wart), and to secure frost-resistant varieties, drought-resistant races, constancy of yield, productivity, high quality of tubers, earliness and many other qualities still undiscovered, which have remained still masked, even on hybridization. The possibility of breeding frost-resistant potatoes has never been previously considered, and now three species possessed of this quality have been found, the most resistant of which withstands frosts of –8°C. Many of the new species are resistant to wart and other diseases as well as blight. Others are resistant to intense drought.

* A full translation of this paper is on file at the Bureau.

The characteristics of the main species of interest for various purposes are indicated, *S. demissum* for frost and blight-resistance combined, *S. Antipoviczii* for blight resistance, *S. acaule*, *S. curtilobum* and others for frost resistance, *S. phureja* for early maturity, *S. Rybinii* for resistance to virus diseases, early maturity and the quality of immediate sprouting of the tubers without undergoing a period of rest, a characteristic possessed also by *S. boyacense* and *S. Kesselbrunneri*; finally *S. phureja* for tolerance of tropical conditions, *S. andigenum* for the ease with which it crosses with the common potato and the high yield of the hybrids and *S. tuberosum* for its quality and high productivity.

These observations make it clear that the original potato introductions to Europe were made from Chile and the neighbouring island of Chiloe, where only *S. tuberosum* is grown. The main bulk of the potato area thousands of miles further north, where all these other species occur, has so far remained unexplored. Hence the universal impression that the cultivated potato consisted of one species alone, whilst the existence of no less than seventeen cultivated species has now been revealed, together with a still greater number of related wild species.

1018. *Kovalenko, G. M. and Sidorov, F. F. 633.491:575.127.2
(Inter-species hybridization of the potato.)
Bull. Appl. Bot. Leningrad 1933: Ser. A (7): 97–106.

An account of extensive breeding operations carried out in the last few years, using the new species obtained from South America in various parental combinations. The success in potato crossing varies considerably in different localities, *e.g.*, in Minsk an average success of 0.7 and in Leningrad of 10 per cent was obtained.

An outline is first given of the objects for which the work was undertaken and the species chosen for each object. Beginning with the wild species, *S. demissum* (2n = 72) and to a slightly lesser degree *S. semidemissum* (2n = 60) were chosen for their combined resistance to blight and frost; *S. Antipoviczii*, *S. neoantipoviczii* and *S. ajuscoense*, all with 48 chromosomes, and one Mexican hybrid species *S. Vallis Mexici* with 36 chromosomes for their blight resistance; and *S. acaule* (2n = 48) and others for frost resistance. The cultivated species *S. curtilobum* (2n = 60), *S. Juzepczukii* (2n = 36) and *S. ajanhuiri* (2n = 24) were used for cold resistance, *S. phureja* (2n = 24) and *S. chaucha* (2n = 36) for earliness, *S. Rybinii* for short period of dormancy, and certain varieties of *S. andigenum*, the main cultivated species of the Andes, on account of the success with which it crosses.

The results of the different crosses are described and tabulated, the species being dealt with in order of their chromosome number. The hexaploid *S. demissum* crossed fairly successfully with *S. andigenum* and *S. tuberosum* when used as female parent, but not as pollen parent. It crossed with a certain amount of success also with *S. Antipoviczii* and *S. semidemissum*. The pentaploids *S. semidemissum*, *S. curtilobum* and *S. demissum* x *S. tuberosum* (2n = 60) behaved somewhat similarly though slightly less successfully.

The tetraploid species *S. Antipoviczii* was also slightly better as maternal species in crosses with *S. andigenum* and *S. tuberosum*, though not with other species of the same chromosome number. *S. neoantipoviczii* behaved similarly and the only success with *S. acaule* was obtained by using it as female. Other tetraploid species on the other hand functioned best as pollen parents, *e.g.*, *S. ajuscoense* and *S. andigenum*. With the latter species successful pollinations were made of *S. demissum*, *S. curtilobum* and *S. tuberosum* and most of the other species gave a certain amount of success. Admirable tuber development was observed on the hybrids with *S. tuberosum*.

With *S. tuberosum* 6,900 crosses were carried out; with some species it functioned best as the pollen parent, with others as maternal parent. It crossed with every species except *S. acaule* and the triploids.

*A full summary of this paper is on file at the Bureau.

The triploid species and hybrids generally resulted in failure. The diploids on the other hand crossed very successfully one with the other and to a certain extent with the hexaploid and tetraploid species ; an exception was found in *S. phureja*, which crossed less readily than the other diploid species. The hybrid *S. goniocalyx* x *S. Bukasovii* was more successful than *S. Bukasovii* itself in pollinating *S. Rybinii*.
Within the species *S. andigenum* and *S. tuberosum* some varieties crossed very much more successfully than others. The best variety of the former species was *f. pacus* and of the latter species the variety Villa Herrera, which with *S. demissum* gave a success of up to 80 per cent. Certain of the F_1 hybrids have proved more efficient than the pure species and this is regarded as one of the most promising ways of effecting difficult specific combinations.

1019. WINKLER, H. 633.491:575.255
Über zwei *Solanum*-Chimären mit Burdonenepidermis. **(On two solanum chimaeras with " burdo "* epidermis.)**
Planta (Berl.) 1934 : **21** : 613–56.
Two periclinal chimaeras in which the epidermis was of the nature of a " burdo "* fused graft hybrid between *S. nigrum* and *S. lycopersicum* appeared among the author's material. Their origin, morphology, histology and cytology are described.
The nature and possible causes of " burdo " formation, the origin of the aberrant chromosome numbers, the conditions determining the aberrant characters, the influence of the inner tissue on the formation of the epidermal characters and the *Crataegomespili* problem and the apparent choripetaly in Ch, one of the two chimaeras, are all discussed at some length.
Evidence is interpreted as shewing that somatic cells from different species may fuse to form one cell, which with its descendants may participate in the formation of one individual (burdo formation) ; while at the same time karyogamy and character transmission take place as in the sexual formation of hybrids.

1020. 633.491:581.162.3
VESSELOVSKII, I. A. 633.491–2.111–1.521.6:575
(Growing potatoes from seeds for northern, high and remote regions of the U.S.S.R.)
Lenin Acad. Agric. Sci., Inst. Pl. Ind., Leningrad 1933 : Pp. 20.
Experiments by various institutions are referred to by which it has been shewn to be practicable to reproduce potatoes by seed in places where reproduction by tubers is not possible. This also serves as a valuable means of avoiding degeneration, virus and other diseases ; it has already been shewn to be practicable in regions of extreme cold or heat and isolation from means of communication and the great saving in tubers that the method effects makes it probable that it will have a still wider application.
Certain varieties transmit their desirable qualities to their offspring, giving a fairly uniform progeny of seedlings. This is the first essential for the success of the method and one or two hybrids possessed of this quality have already been produced.
The seed formation at the polar research station is being made use of in an extensive breeding programme for producing new potatoes possessed of frost or blight resistance or extreme earliness, by use of the new South American potato species. For frost resistance *Solanum demissum* and *S. acaule* are used but this necessitates considerable time for results to materialize ; for supplying

*The name burdo was applied (1912) by the author to that type of graft hybrid in which at the place of union between scion and stock a total or partial cell fusion (more or less resembling the fertilization process) occurs between at least one cell of the scion and the stock and the resulting product becomes the starting point of the graft hybrid structure formed.

immediate needs the less frost-resistant forms cultivated in the high Andes are being used in mass hybridizations, from which hybrids withstanding as much as –2.3°C. have already been produced. Of these the hybrids of Epicure x *S. curtilobum* were the most resistant. Some of the resistant hybrids had a starch content of up to 18 per cent and gave as much as 1.5 kg. of tubers from one seed.

The most frost-resistant species is *S. acaule* (48 chromosomes), next follow *S. demissum* (72 chromosomes), *S. curtilobum* and *S. semidemissum* (60 chromosomes) and *S. ajanhuiri* (24 chromosomes), followed again by forms of *S. andigenum* (48 chromosomes). It is important to have as large a number of forms of these species as possible, since variation occurs within the species. Inbreeding is also a method of increasing the number of forms, since segregation has been observed in inbred populations in respect of frost resistance as well as morphological characters.

The species shew extreme differences in photoperiodic reaction, both long-day, short-day and neutral species having been observed.

With reference to the above considerations the points to be observed in choosing the parental varieties are indicated. Similarly for earliness: the most suitable parental varieties of *S. tuberosum* are given. *S. Rybinii* (24 chromosomes) is the best of the South American species, followed by certain forms of *S. andigenum*; the results of crosses of these forms with various forms of *S. tuberosum* are summarized.

A brief description is given of the method of growing the seedlings.

1021. 633.491–2–1.521.6:575
633.491 Chippewa
633.491 Katahdin
STEVENSON, F. J. and CLARK, C. F. 633.491 Golden
New potato varieties.
Amer. Pot. J. 1934: **11**: 85–92.

The breeding programme had as its aim the production of virus resistant varieties of potatoes and a large number of varieties resistant to mild mosaic are now available. Two of these have been named and are being distributed to growers. The seedling No. 41956 is resistant, if not immune, to latent mosaic and it is hoped to combine resistance to both forms of mosaic in one variety.

Resistance to leaf-roll and spindle tuber is also engaging attention.

Several varieties and seedlings (six seedlings being selections of a progeny of Katahdin naturally fertilized) have shewn various degrees of resistance to late blight. Though none of the apparently blight-resistant seedlings so far produced are very promising commercially the best are being used in hybridization to combine late blight resistance with other desirable characters.

Among the russet skinned varieties a seedling No. 44537 has shewn marked resistance to common scab and though its yield is below that of Cobbler it is being used as a parent in crosses with good yielding types.

The performances and probable ultimate value as regards disease resistance and yield of Katahdin, Chippewa and Golden (see " Plant Breeding Abstracts," Vol. IV, Absts. 431/436) are reported. So far only the first of these three is being increased as rapidly as possible for certified seed. Golden has not given particularly promising results but more extensive tests will be made in 1934.

1022. NASSONOV, V. A. and YAGER, F. CH. 633.491–2.111–1.521.6:581.4
(Anatomical peculiarities of stems and leaves in hardy potato varieties.)
Bull. Appl. Bot. Leningrad 1933: Ser. A (7): 107–16.

Attention is called to a number of anatomical features common to all the new cold-resistant species and hybrids, *e.g.*, little secondary wood, unusually large numbers of stomata, etc. etc. The observations were carried out on eleven wild species, six cultivated species from the Andes,

four forms of *S. andigenum*, nineteen of *S. tuberosum* and thirty hybrids. It has not yet been possible to decide whether these features are directly connected with hardiness or whether their presence results merely from the fact that nearly all the hardy forms are wild species or hybrids from them. The hybrids, in addition to inheriting the hardiness of the wild species also inherit their anatomical structure, as is shewn by hybrids of *S. demissum* x *S. semidemissum* and *S. demissum* x *S. Antipoviczii*, which strongly resemble *S. demissum*, and of *S. acaule* x *S. aracc papa*, *S. Rybinii* x *S. Bukasovii* and *S. ajanhuiri* x *S. Bukasovii*, all of which resemble the maternal parent, and *S. goniocalyx* x *S. Bukasovii* which resembles the paternal species.

1023. Berkner, F. 633.491–2.4
Die Ursachen des Kartoffelschorfes und Wege zu seiner Bekämpfung. (**The causes of potato scab and ways of preventing it.**)
Landw. Jb. 1933 : **78** : 295–342.

After a general account of the disease and the various influences, environmental, manurial and fungal, possibly involved in its origin, the methods of prevention are discussed. Of these there are various but the ultimate is the breeding of varieties resistant to attack. Repeated observations have shewn that the degree of attack is a more or less constant varietal character, though no true immunity is known to exist ; the variety Jubel is highly resistant and others are tolerably so. The observations made on 300 varieties in the years 1929–1932 are given and the close agreement between the observations of the different years *inter se* and with observations of other workers demonstrates the hereditary nature of the resistance. The behaviour of the varieties of high cooking quality is tabulated. Of the varieties tested 35 were classed as scab-resistant and 55 as rather resistant.

An examination of the genealogy of the resistant varieties shewed that the variety Jubel, wart- and scab-resistant, figures with unusual frequency in the parentage of scab-resistant potatoes. Some of the scab-resistant varieties are also wart-resistant, others are not, and it is clear therefore that the two characters are not inherited together. Other varieties have also figured largely in the genealogy of the scab-resistant varieties, *e.g.*, Daber, resistant to wart, susceptible to scab, and Flourball ; and genealogical tables are given for the best varieties to serve as a guide in the choice of parental varieties for future breeding work.

1024. Kovalev, N. V. 633.491–2.411.4–1.521.6:575.127.2
(**A contribution to the question of breeding the potato for resistance to *Phytophthora*.**)
Bull. Appl. Bot. Leningrad 1933 : Ser. A (7) : 91–96.

Recent experiments, mainly in Germany, are quoted which shew that all varieties under cultivation, early and late varieties included, are susceptible to *Phytophthora infestans*.

This is not unexpected, since all the varieties belong to a single species, *Solanum tuberosum*, and have descended from two introductions from South America. The discovery of fourteen new cultivated species and, more important still, of thirty-two new wild species, from Mexico and South America has changed the whole position. Some of these new species have exhibited resistance, in varying degrees, to blight, and their hybrids with the cultivated potatoes of Europe and the Andes are also resistant. The highest degree of resistance is possessed by *S. Antipowiczii* and *S. demissum*, whilst *S. vallis Mexici* and *S. ajuscoense* are moderately resistant.

Reference is made to the resistant hybrids produced by Müller from " wild " parents. The Soviet workers have crossed the new resistant species among themselves and obtained hybrids resistant to artificial infection both in the greenhouse and the field. Several hundred plants of twenty-seven crosses of the new species with *S. tuberosum* have been tested and two of these have proved resistant, *viz.*, *S. demissum* x Alma and *S. demissum* x Nobelia. Hybrids of the cultivated potato of the Andes, *S. andigenum*, are also resistant.

In view of the reduction of attack by late planting it will be an advantage to breed for cold resistance along with blight resistance, so that the risk of infection may be further reduced by delaying the planting period.

1025. BRESLAVETZ, L., MEDWEDEWA, G. and MAGITT, M. 633.5:576.3
Zytologische Untersuchungen der Bastpflanzen (*Apocynum*, *Boehmeria*, *Hibiscus*, *Abutilon* und *Crotalaria*). [**Cytological investigations on fibre plants** (*Apocynum*, *Boehmeria*, *Hibiscus*, *Abutilon* **and** *Crotalaria*.)]
Z. Züchtung 1934 : A **19** : 229–34.

These represent merely preliminary investigations on the plants mentioned. At metaphase in *Apocynum venetum* 22 chromosomes were present, in only one or two forms of different origin was there any marked individuality of the chromosomes.
Cortical cells of *Boehmeria nivea* had 28 chromosomes which could be easily distinguished from each other. *Hibiscus cannabinus* in the cells of the cortex shewed roundish inclusions in the plasma and still larger globules in the nucleus itself. The 36 chromosomes had a marked individuality.
The most interesting plasmatic inclusions were observed in *Abutilon*. The 42 chromosomes were very small and though some could be distinguished by their size and shape it was often difficult to get a clear view of them.
Crotalaria juncea also shewed some interesting cell inclusions and the 16 pairs of chromosomes were of various shapes.
The resting nucleus of *Hibiscus esculentus* frequently shewed irregularly shaped masses or was made up of a number of large granules. The number of chromosomes was considerable, about 132, and they were too small and too numerous for differences in size an dshape to be distinguished.

1026. KEARNEY, T. H. 633.51 *Gossypium armourianum*
A new *Gossypium* of Lower California.
J. Wash. Acad. Sci. 1933 : **23** : 558–60.

The new species, found so far only on San Marcos Island in the Gulf of California, has been named *G. armourianum*. It is most nearly allied to *G. Harknessii* and the features whereby it can be distinguished from this species are enumerated, together with a full description of the new species.
It is highly xerophytic.

1027. PENZIN, JA. E. 633.51:575(47)
(Results of trials with cotton in the Kuban for 1930).
Publ. Cott. Res. Inst. for New Regions, Simferopol 1931 : Issue I : Pp. 47.

The variety testing section carried out trials on a number of varieties obtained from the Central Asia NIHI and the Transcaucasian NIHI and on certain special new early maturing varieties from the former, but none of them proved entirely suitable to the region. Breeding work is necessary therefore to produce new forms on the spot.

1028. MAUER, F. M. 633.51 *G. barbadense*:575 (47.9)
(The Egyptian cotton plant in Transcaucasia.)
Bull. Appl. Bot. Leningrad 1933 : Ser. A (8) : 147–67.

The history of the introduction of Egyptian cottons into the U.S.S.R. is briefly traced, and the climatic conditions of the cotton-growing regions of the U.S.S.R. compared with those of Egypt. The varieties at present in widest cultivation are briefly described and the results of recent variety tests presented.
The production of high-yielding varieties with ultra-long, long and medium-long lint, high ginning percentage, large bolls, early maturity and resistance to disease, and adapted to the conditions of the Azerbaijan S.S.R. cotton zones is the problem facing the breeder. Four main zones are distinguished, each requiring a different type.
Breeding work was begun in 1931 by ZakNIHI. The origin and characteristics of the best selections being used for breeding material are given. The American Egyptian and the Upper Egyptian types are the most suitable to the region and all the best selections of the last few years have come from these. The other two groups, Lower Egyptian and Sea Island proper, are less favourable.

All these varieties have, however, a number of serious defects, which on the other hand are absent in many of the cottons introduced direct from South America, Peru and Brazil in particular. Some of these have very large bolls, weighing 7–9 g., a ginning out-turn up to 40 per cent, lint length up to 50 mm. and the greatest possible diversity in form of bush ; some of them display resistance to bacterial diseases, others extreme earliness. By using these cottons in hybridization it will be possible to create new forms of Egyptian cotton very much better suited to the district.

1029. KOVALEVSKY, G. V. 633.51:575(54)
(The rôle of Indian cotton growing in the national economy of U.S.S.R.)
Bull. Appl. Bot. Leningrad 1933 : Ser. A (8) : 173–78.

On account of their extreme earliness, tolerance, high yield and ginning percentage the Indian cottons are of considerable interest to the U.S.S.R. Reference is made to the successful combination by hybridization in India of yield and length of lint and of cottons resistant to wilt and other diseases. The various improved cottons produced in different presidencies in India are described and other matters in which the Soviet Union might benefit by Indian research and experience are mentioned.

1030. 633.51:575.1
MALINOVSKII, N. A. 633.51:575(47)
(The genetics of cotton.)
Bull. (Trudy) ZakNIHI, Baku 1933 : No. 36 : Pp. 39.

Following upon introductory remarks on breeding methods in general, a brief outline is given of the history of cotton cytology, including reference to P. A. Baranov's five types of chromosomes, differing in form ; cotton genetics is similarly reviewed, by reference to the most important literature on the subject, each character being taken in turn. Having dealt with the work done in other countries the author turns to the achievements of the U.S.S.R. in cotton breeding. G. S. Zaitzev produced four long-stapled cottons, numbers 2017, 2005, 1838 and 1876, and effected a cross between *Gossypium herbaceum* and *G. hirsutum*. This and a similar hybrid obtained later by the Azerbaijan Breeding Station were completely sterile. Interspecific hybrids of great interest have been made by S. S. Kanash (see " Plant Breeding Abstracts," Vol. IV, Abst. 193).

The author calls attention to the comparatively small contribution made by Soviet workers to the subject, and deprecates the fact that so little advance has been made in any country in the genetics of quantitative characters, which are at the root of all the main agricultural qualities, and that so many characters have been studied in interspecific crosses without verification in crosses within the species.

An examination of the world collection of cottons has disclosed desirable characters scattered throughout a very wide range of varieties. The Egyptian cottons have the best textile qualities, the Uplands have the highest yields, whilst the Old World cottons possess characters such as extreme early maturity, high ginning percentage and resistance to wind damage, the latter being a quality of great moment for mechanized harvesting when only one picking is possible. The author recommends the method of " cyclic crossing " : for earliness all possible combinations between three types of parent, early, medium and late should be made in the American cottons, involving 18 crosses, plus all combinations of two types of Egyptian (8 crosses) and of Asiatic cottons (8 crosses), thus involving 34 crosses in all. Other characters which are of importance and should be treated on similar lines are the following : size of seed, ginning percentage, lint length, fuzz, percentage shedding, resistance to wind damage, presence of petal spot, form of leaf lobe and colour of pollen. The only way to accomplish this is by intensive collective work on the part of the three cotton breeding centres.

The possibilities attaching to the methods of experimentally induced polyploidy and mutation are illustrated by reference to the results of various Soviet workers and to verbal communications of Ol'šanskii, who by the application of high voltage X-rays to germinating seeds obtained one plant whose bolls dehisced a month earlier than the controls. The author's own experiments with lower voltages, 50-70 kw., at a distance of 30 cm., have shewn that also in this way a distinct

alteration of the phenotype can be brought about, followed by abnormalities of meiosis in the plants produced.
Attempts are being made to produce polyploids from the adventitious buds which develop from the callus formed at the root collar on wounding. The excessive segregation which invariably occurs in later generations of American x Egyptian hybrids which in the F_1's are so desirable in almost all characteristics, might be avoided if chromosome duplication could be induced in the F_1. In addition to regeneration, the influence of low temperature and narcotics is suggested as a possible way of inducing polyploidy. The wide segregation of interspecific hybrids is of value, however, in increasing the variability of the population and with the same object in view a complete collection of the cottons of the world should be maintained.

1031. MOORE, J. H. 633.51:575.11:581.49
Relation of the quality of cotton planting seed to length of staple.
Bull. N.C. Agric. Expt. Sta. 1934 : No. 296 : Pp. 3.
Data collected in 1930-33 shewed that improved seed stocks give higher yields under farm conditions than unimproved or mixed seed and also that pure and improved seed are the main factors in producing uniform $^{15}/_{16}$ and $1^{1}/_{16}$ inch staple.

1032. HARLAND, S. C. 633.51:576.16:575.1
(The genetic conception of the species.)
C.R. Acad. Sci. U.R.S.S. 1933 : 4 : (N.S.) 176–86.
Genetical and hybridization studies of *Gossypium hirsutum* and *G. barbadense* are described and evaluated from the evolutionary point of view. Both species which belong to the New World species of *Gossypium* are morphologically different and have 26 chromosomes and a series of homologous characters. They interbreed readily and the hybrids, with few exceptions, shew normal chromosome pairing. The homologous characters, such as the presence or absence of the spot at the base of petals, within the species always shew a close approximation to Mendelian segregation, whereas in interspecific crosses they exhibit typical " blending inheritance." This is explained by the author as being due to the basic genes for the homologous characters, having, owing to a long separation through geological ages, become non-identical and having evolved into new multiple allelomorphs, each accompanied by a specific modifier system and consequently the homologous characters are genetically different.
Hence, the author concludes, the first step in the evolution of a species is the production of new multiple allelomorphs which can be affected by new modifier complexes, thus rendering the building up of new characters possible through natural selection and modifiers. Further evidence for this hypothesis may be seen in the genetical behaviour of the crinkled mutant of *G. barbadense* which, in crosses with *G. hirsutum*, gives F_1 intermediate and " blending inheritance " in F_2, but after seven backcrosses, when transferred to a pure *hirsutum* background and in further crosses with *G. hirsutum* shews the normal monohybrid ratio and " blending inheritance " with *G. barbadense*.
According to the writer's conception of the genetic constitution of species, the modifier system represents an essential constituent of a species ; also as a consequence of ecological differentiation the modifier systems have, by natural selection, developed different inherent structures in the two widely separated areas in which *G. hirsutum* and *G. barbadense* are found, and thus a new dominance mechanism has been formed. In this hypothesis the author differs from Fisher, according to whom the modifying genes are not of selective value on their own account, but because they improve a heterozygous mutation.

1033. KOKUEV, V. I. 633.51:581.444
(Cottons with the zero type of branching and their practical value.)
Central Asia NIHI, Moscow and Tashkent, 1933 : Pp. 25.
The cluster type of cotton plant in which several bolls are borne on a single internode as opposed to a long sympodium with several internodes is of advantage for mechanized harvesting. It also reacts more favourably to dense planting. Although the Egyptian cottons are characterized by long sympodial internodes and the American cottons by short, individuals can be found

among the Egyptian cottons with internodes shorter than the average American and vice versa. Observations were made on the form of sympodium in homogenious lines of a number of varieties representing the different types and the lengths of the sympodial internodes are tabulated. The types are referred to as 0 to IV.

As early as 1925 crosses were made between Barraka line 150 of the 0 (cluster) type and a number of varieties representing the different types according to internode length ; in later years the work was extended.

The F_2 generations from crosses with types I and II, grown in 1927, contained individuals of the 0 type conspicuous both for their high productivity and lint quality as compared with the parental forms which is shewn by tables of the F_2 yields. On these grounds the author refutes Zaitsev's statement that the cottons of this type are useless for practical purposes. In crosses mainly of Barraka 150 and Triumph 35, many 0 type hybrids have inherited the favourable characteristics of the parents, though others have failed to do so. Already 300 lines of this type have been produced and some of them are regarded as suitable for commercial utilization.

Some develop a " cap " of bolls at the tip in place of the growing point, a character which is transmitted to the offspring and is of great practical value in that it increases the yield. The 0 type proved to be recessive in the F_2 generations of the crosses. The only essential for producing commercially valuable hybrids of this type is that the F_2 populations be sufficiently large, in view of the complex nature of the other desirable characters. The cluster character is inherited equally simply in interspecific crosses of American and Egyptian cottons. F_5 hybrids fully constant in this and in agronomic characters have already been obtained from such crosses. They are commercially inferior on account of low quality and yield ; however, only 240 F_2 plants were grown and satisfactory hybrids should be produced by careful choice of parental species and the use of larger populations. Transgression was observed in these crosses for large boll, earliness, short lint and other characters.

1034. Masenko, A. M. 633.51.00.14(47)
[Results of experiments with cotton at the Bardin Experimental Section of ZakNIHI (1929-30.)]
Bull. ZakNIHI Sci. Ser. 1933 : No. **38** : Pp. 41.

In the section of variety testing, trials were carried out in 1929 with 20 varieties of American cotton, Egyptian varieties, which also thrive well, being introduced only in 1931. The highest in gross yield and in yield of lint were the medium early varieties, followed by the medium late ; the late varieties yielded least of all.

In 1930, 21 varieties were tested and the results accorded entirely with those of the previous year. The total yields in 1930 were less, which proved to be the result of a lower total number of bolls per plant.

1035. Rusanov, F. N. 633.512:581.9
(Results of the expeditions for the study of wild *Apocynum*.)
Bull. (Trudy) New Bast Fibres Res. Inst. 1933 : **5** : 3–12.

The results of repeated expeditions extending over the period 1926 to 1932 to study the species in all the different regions where they occur wild are reviewed, critical reference being made to the various publications in which the results have from time to time been reported. The author expresses the opinion that the study of the wild species will lend considerable aid to the solution of many of the problems connected with the cultivated forms.

1036. Crescini, F. 633.522:575.11
Indagini intorno all'eredità dei caratteri in "*Cannabis sativa* L." **(Notes on the inheritance of characters in *Cannabis sativa L.*)**
Ital. Agric. 1934 : **71** : 205–25.

To test the genetical make-up of a short and early flowering (May) hemp from Hungary it was crossed with the tall, late-flowering (August) Italian sort " Carmagnolese " and the progeny studied in F_1, F_2 and the backcross of F_1 with the Italian variety. The Hungarian hemp

used, when isolated and selfed, retained its characteristics and shewed a satisfactory uniformity. In flowering and height the male plants of the F_1 were intermediate (June).
There was no real correlation between height and time of flowering in the male plants though in some cases an apparent correlation was observed.
The average height of the male plants in the parents as well as the progeny is greater than that of the female plants which however, though shorter, are thicker.
There was a positive correlation between height and thickness of the stem.

1037. Sun, Von-Gee 633.523–1.421
(A study on the field technique of jute.)
J. Chinese Agric. Soc. No. 114 : Pp. 48.
The effect of size of plot and of border and the influence of plot shape, of soil differences, number of replications and size of plot on the variability of yields were studied. Suggested lay-outs for ensuring sufficiently accurate results in variety tests and cultural experiments etc., are described.

SUGAR PLANTS 633.6

1038. 633.61:575.24.00.3
Cross, W. E. 633.61:575.242
Otra mutación de la P.O.J. 36, de mayor productividad. La caña " Paz Posse." **(Another mutation of P.O.J. 36, with higher yielding capacity, the " Paz Posse " cane.)**
Rev. Ind. Agric. Tucumán 1933 : **23** : 104–08.
A further mutant of P.O.J. 36, characterized by higher yield even than the preceding ones (see " Plant Breeding Abstracts," Vol. III, Abst. 687) is described. Obtained by selection by Don Ramón Paz Posse ten years ago, it resembles 36 in all but its colour, which is purple ; its greater vigour of growth more than compensates for a slightly reduced sugar content.
The results of comparative tests executed from 1926 to 1932 on the original and mutant canes grown under identical conditions and the remarks of a number of planters are reported in support of these statements.

1039. Bremer, G. 633.61:576.312
De cytologie van het suikerriet. 7de Bijdrage. Een cytologisch onderzoek van een vijftigtal in 1929-1930 op Java geïmporteerde rietsoorten. **(The cytology of sugarcane. 7. A cytological investigation of 50 varieties of cane imported into Java during 1929-30.)**
Arch. Suikerind. Ned.-Ind. 1934 : No. 5 : 141-66.
A large amount of material obtained from different sources and consisting of *Saccharum officinarum* forms, and various glagah types of *S. spontaneum* as well as a number of *S. officinarum* x *S. spontaneum* crosses and other hybrids and finally a number of species belonging to certain related genera was examined.
The chromosome numbers of the varieties and hybrids are discussed in detail.
As anticipated from previous investigations a form of *S. spontaneum* from the Philippine Islands was found to have 80 chromosomes diploid. A number of glagah forms from the Dutch Indies were characterized by the haploid number 56 which appears to be widespread in the archipelago. Seven of the glagah types of Celebes were found to have approximately 96 chromosomes diploid instead of 80, and the possibility that they may all belong to one group with *S. spontaneum* is being examined. They may very likely have originated from a cross between two forms with 40 and 56 haploid chromosomes respectively.
Extreme polymorphism both in external characters and in nuclear constitution is evident in *S. spontaneum* in which the highest diploid number of chromosomes is 126, while types with 112, 96, 80 and 72 and about 60 chromosomes also occur in types from various parts of the world ; hence forms must be examined morphologically and cytologically from a great many more regions in the area of distribution before these species can be grouped into subspecies.
Chromosome doubling was found to occur in the crosses between noble cane and *S. spontaneum* from Coimbatore and noble cane and Kassoer. The possible existence of a relation between the

sugar content of a varietal hybrid and the differences in the chromosome complements of its parents is touched upon.
The thirteen forms of *S. officinarum* examined all shewed 80 chromosomes in diploid cells. Among the forms probably derived from crosses between *S. officinarum* and some unknown cane were Striped Tip (with 88–90 chromosomes), Uba Marot (with 112–113 chromosomes), Teboe Tigoe Tenggaron (with 81 chromosomes), B.J.P. 38 (with 79–81 chromosomes) and B.J.P. 201 (with 70 chromosomes). Their possible origins are discussed.
The chromosome numbers of *Erianthus arundinaceus*, many members of the *Andropogoneae* and *Miscanthus* species from various sources were studied and a tetraploid and a hexaploid form of *Erianthus arundinaceus* are recorded.

1040. Arceneaux, G., Stokes, I. E., Bisland, R. B. and Krumbhaar, C. C. 633.61.0014(76.3)
Variety tests of sugarcanes in Louisiana during the crop year 1931-32.
Circ. U.S. Dept. Agric. 1933: No. 298: Pp. 32.
The yields and disease resistance of a large number of varieties and two seedlings are provisionally stated to be of considerable promise.

1041. Cross, W. E. 633.61.00.14(82)
Las cañas " tucumanas " de semillero. Informe de los ensayos de los años 1932 y 1933. (**The " Tucumán " seedling canes. Report on the tests of 1932 and 1933.**)
Rev. Ind. Agric. Tucumán 1933: **23**: 135–64.
The results of two further years observations on the Tucumán seedlings are recorded. The numbers 1 to 300 proved again inferior and are finally to be discarded. Of the numbers 301–600, promising results are expected from Tuc. 407 and 454, as regards yield and Tuc. 472 is also resistant to mosaic; Tuc. 544 is of possible promise, being also resistant to mosaic.
In the series 601–1,100 raised by selfing or crossing promising parental canes, none were superior to P.O.J. 36 in both yield and sugar content. Series 1,100–1,424 from crosses of Co. 243 x Co. 244, contains a very high proportion of good canes and the performances of the best of them are tabulated. Reckoned in kilos sugar per ha., Tuc. 1376 gave 8·853, Tuc. 1111, 8·427, Tuc. 1406, 8·374 and Tuc. 1422, 7·259 as compared with 6·455 for P.O.J. 36. The second and third of these canes exceeded P.O.J. 36 in both yield and sugar content considerably.
In the remaining series, mainly raised in 1932, the characteristics of the groups from different parents are indicated.

1042. Cross, W. E. 633.61.00.14(82)
Ensayos con las cañas Coimbatore. (**Tests with Coimbatore canes.**)
Rev. Ind. Agric. Tucumán 1933: **23**: 187–98.
Some of the Coimbatore canes, especially those containing both *Saccharum spontaneum* and *S. Barberi* in their parentage, are of special interest in the Argentine. The only one of the Coimbatore canes tested which proved promising for Tucumán conditions was Co. 281. The majority were inferior to POJ 36 in sugar content and many also in resistance to mosaic. Co. 290 is regarded as a very promising cane and will be tested extensively. It gave very high yield and shewed marked superiority over other canes in ratooned crops. Other promising canes which are to be subjected to further test are Co. 270, Co. 272 and Co. 284; they exceeded POJ 36 in tonnage, though not in sugar percentage, and were free from mosaic.

1043. Kohls, H. L. and Down, E. E. 633.63–1.531.12:575.14
Influence of inbreeding and selection on seed production of space-isolated mother beets.
J. Amer. Soc. Agron. 1934: **26**: 327–32.
Inbreeding and selection of space-isolated mother beets resulted at least for a time in an increase in the average production of seed per mother beet. This increase may be largely due to automatic elimination of self-sterile mother beets and of partly sterile ones by selection.

1044. Immer, F. R. 633.63.0014
Varietal competition as a factor in yield trials with sugar beets.
J. Amer. Soc. Agron. 1934 : **26** : 259–61.

Three year tests in single alternating rows and in four row plots of two varieties of sugar beet differing in growth habit shewed that in trials of beet varieties of markedly different size, plots at least three rows wide must be used and at least one border row on each side of the plot must be discarded at the harvest. It should, however, be noted that, though the yield of the more productive variety clearly profited at the expense of the less productive one, similar effects were not observed with regard to the surcrose per centage on apparent purity coefficients.

STIMULANTS 633.7

1045. Davidovitch, S. B. 633.71:575(47)
(Breeding Abkhasian tobaccos.)
Bull. Inst. Tobacco Ind., Krasnodar 1933 : No. 101 : Pp. 54.

This is an elaboration of the work reported in " Plant Breeding Abstracts," Vol. III, Abst. 99. The author enlarges on the history of the Abkhasian tobaccos which were imported in the middle of last century by settlers from Turkey. The original material represented very mixed unselected forms, but of high commercial quality, and has from the time of its introduction been undergoing a process of natural selection of the types most adapted to the region, together with a certain amount of deliberate selection on the part of the planters. Natural mutation and cross-pollination have been further sources of change and possibly degeneration.

Systematic selection and breeding was started in 1926, with improvement of quality as the chief aim. Various morphological characters are indicated by the use of which preliminary discarding of undesirable types is effected. These characters are the number and coarseness of veins, length of petiole and size and shape of leaf. The characteristics of *Nicotiana tabacum* var. *macrophylla* are rated high, since this variety has contributed more of the quality of sweet flavour than the other varieties *fruticosa* and *brasiliensis* which have gone towards the composition of the present Abkhasian tobaccos. The ratio of leaf length to breadth and the disposition of the lateral veins are the characters by which the amount of *macrophylla* in the parentage is estimated. The arbitrary nature of these characters is fully realized but they are of use in indicating the structure of the leaf and the most probable varietal parentage of any particular plant.

The next object is to raise the yield. In the Trebizond type this has already been accomplished in one race which has outyielded all others. Number of leaves, their size and the solidity of their tissues all receive attention from the point of view of yield. Resistance to disease and early and uniform ripening are also important considerations in breeding.

A collection was made of all the local types, 1,100 in number, and observations were made on all these with respect to the above characters. Elite lines were produced by repeated single plant selection. A number of hybrids in F_3 and F_4 were also tested in 1930, from crosses of Samsun x Dubec, Trebizond x Dubec and American x Trebizond. One improved strain of Samsun, Number 27, was released in 1932.

The results of the observations on 134 strains in the first élite generation examined in 1930 are given for each character in turn. The number of lines combining all the desired qualities was extremely low. A table is given shewing the correlation between different pairs of characters, from which it appears that significant but weak positive correlations exist between number of leaves and yield, vigour of germination and time of flowering, disposition of lateral veins at base and centre of leaf. Negative correlations exist between number of leaves and earliness, yield and earliness, solidity of leaves and size of main vein, growth of stem in first ten days and time of flowering. The following characters were strongly correlated positively : yield and plant height, yield and area of middle leaf, growth of stem in first and second ten days, growth of stem in first ten days and height at flowering ; and negatively, ratio of leaf length to breadth and angle made by veins at leaf base, density of veins and area of leaf.

On the basis of these observations a relative value has been assigned to each line, representing the degree of expression of the various characters and hence its potential value for any definite purpose. These values have been compiled into a table for reference, which however is not published.
A suggested classification of the Abkhasian tobaccos using the above morphological characters is outlined.
The results of variety tests carried out on the station with a number of the selected strains are given. In yield the best Samsun strain (Number 132) exceeded the standard by 17·5 per cent and the best Trebizond strain (Number 1589) by 45·5 per cent. These two varieties retained first place in variety tests carried out at five distinct regions. They were also superior in commercial quality, Number 1589 to a very high degree. Other numbers proved highly suited to certain definite regions only.
Indications for future development of the work are given.

1046. Tollenaar, D. 633.71:575(92.2)
II. Veredeling en selectie. **(II. Breeding and selection.)**
Meded. Proefst. Vorstenl. Tab. Klaten (Java) 1933 : No. 77 : 17–33.

This report on the station's activities deals with (1) the work on new crosses of tobacco, (2) mutations obtained by X-ray irradiation and plot tests of more or less fixed types on various estates, (3) the subsequent further selection by expert growers in large scale comparative trials with numbers in cultivation in order to discover the best types for the different estates, and (4) the results of tests for burning properties and selection for quality.
The results obtained from a number of varietal crosses on different soils and estates are described in detail.
Two plants derived from a (Timor x Kanari) x E3K 66 (F_2) cross and externally resembling the Vorstenland type, have also shewn considerable resistance to *Phytophthora* ; they have been crossed with KW 10 and twenty of their progeny are being retained for selection for resistance and quality.
The best plants from the best plots of Kanari crosses *inter se* have been carried on to F_4 and F_5 and five progeny of the original KW 12 and KS 63 and one of the cross KW 47 x KS 63 are to undergo further selection.
Many of the X-ray mutants have produced useful new types. Gene mutations are regarded as more likely to be of practical value than chromosome mutations, for in the former case little deviation from the characters of the parent type is to be expected and a constant line can often be obtained in two generations : chromosome mutations on the other hand involve more extensive changes in the genotype and a more rapid tendency to reduced fertility and should therefore be rejected in breeding material. X-ray plasma mutations due to abnormal tissue and cell development represent another danger which must be avoided by a preliminary sowing before using seed on a large scale. Furthermore, a possible slow deterioration in quality as a result of an unfavourable completely recessive mutation arising in a heterozygote should also be guarded against by annual comparison of the particular generation reached by the mutant with the original generation of good quality.
A new mutant, chlorina A, closely related to the chlorina B mutant previously evolved has proved to be possessed of superior characteristics in a number of tests, though in some trials it was surpassed by a secondary mutant *brachyfolia* which was to be tested in 1933 with another mutant *rotundifolia*. B chlorina x KW 10 (F_1) is to be tested in 1934 on a number of estates both in variety trials and also with B chlorina and A chlorina lines separately.
In the concluding section detailed results are given of tests of the recent KBS 1, E3K and E2K lines evolved by the experiment stations and of some of the lines undergoing selection on various estates. Of these KBS 1 proved specially good in quality, burning time and length of leaf. E3K 66 as in previous years was the best of the E3K lines and selection is to be continued. Finally it has now become clear that selection from the old unselected seed mixtures of Y 10 and Kanari has been a successful undertaking.

1047. Beisser, E. 633.71:575.127.2:576.356:575.11
Zytologisch—genetische Untersuchungen an den Bastarden *Nicotiana tabacum* x *Nicotiana Rusbyi* und ihren Rückkreuzungen zu *N. Rusbyi* und *N. silvestris*. I. Die Nachkommen aus reduzierten Eizellen. **(Cytological and genetical investigations on the hybrids *N. tabacum* x *N. Rusbyi* and their back-crosses with *N. Rusbyi* and *N. silvestris*. I. The progeny from reduced egg cells.)**
Z. indukt. Abstamm.–u. VererbLehre. 1934 : **67** : 115–51.

Observations of the embryo sac mother cells of the hybrid *N. tabacum* x *N. Rusbyi* shewed that though their behaviour was in general similar to the pollen mother cells, yet some univalents split in the first division, some bivalents failed to separate and in certain other minor points the behaviour was less regular. This hybrid was back-crossed by pollinating with *N. silvestris* and 25 of the resulting plants examined cytologically. The majority contained mainly univalents with a few bivalents, all in a highly confused and irregular state. Certain cells where the number of univalents was particularly high suggested the formation of restitution nuclei. The total number of units was equal to 24 in seven plants only, in all the others it was greater or less, again indicating irregularities in the embryo sac mother cells of the F_1. However, seven plants with $12_{II} + 12_I$ were observed, this being very much in excess of the expected number, which is explained by the greater viability of the egg cells with 12 bivalents compared with those with the lower numbers. In the back-cross with *N. Rusbyi* seven plants out of eight had 12 univalents ; which indicates a still more rigorous elimination of the egg cells, and in this case also zygotes and young plants, with intermediate chromosome numbers. The total number of units was generally greater than 24, a further indication of irregularities of meiosis in the F_1 and occasional failure of the bivalents to separate. The presence of trivalents in these plants points in the same direction.

A full description is given of the parental species and the F_1 hybrids, which in nearly all respects shewed dominance of the *N. tabacum* characters, though some characters were intermediate. In the back-cross progenies monofactorial inheritance was established for leaf, petiole and flower colour. Back-crosses with *N. tabacum* shewed that the protrusion of the stigma and anthers was dependent upon three factors, of which one is an inhibiting factor derived from *N. silvestris*, as back-crosses with this species shew, the other an intensifying factor from *N. Rusbyi*, both acting on a basal gene. *N. tabacum* contains corresponding neutral genes, except var. *petiolaris* which possesses the inhibitor.

For colour of anther filaments one factor is operative, which however only functions in presence of the colour factors contained in *N. tabacum* var. *macrophylla* and in *N. Rusbyi*. There are indications of linkage between an intensifying factor and one of the colour genes. The results further indicated that *N. Rusbyi* contains two genes for unbranched habit and *N. silvestris* one for branching, *N. tabacum* containing the corresponding recessives.

In regard to quantitive characters, great variation was observed, such as to indicate the action of multiple factors. However, most forms resembled *N. tabacum*, either the variety participating in the cross or some entirely different one, and intermediate forms were rare. Certain forms very closely resembling *N. Rusbyi* or *N. silvestris* also segregated. This is illustrated for the leaf form, flower form and flower size. This fact is shewn to be in harmony with the chromosome behaviour, the presence of a greater or smaller number of chromosomes from any one species determining the degree of expression of the characters of that species, thus making possible the appearance of plants more nearly similar to the parental species than the F_1 was. When the individual dimensions of the flower are considered they are seen to be inherited independently of one another and there is no evidence of linkage between any of the factors governing them.

1048. Kostoff, D. 633.71:575.127.2:576.356.2:575.116.12
(Crossing over in *Nicotiana* species hybrids.)
C. R. Acad. Sci. U.R.S.S. 1934 : No. **9** : Pp. 7.

In interspecific hybrids of *Nicotiana* conjugation often occurs between certain of the chromosomes though when they separate a restitution nucleus is formed, leading to the development of dyads

and unreduced gametes. In a number of cases quoted, where such hybrids were used to pollinate homozygous plants of one of the parental or of a third species, and the chromosome numbers of the resulting plants indicated that an unreduced pollen cell had functioned, clear morphological differences were nevertheless observed in the plants so produced, sometimes in one character alone, sometimes in up to four or more characters. From this it is evident that the unreduced gametes are not identical and that some sort of interchange has occurred between the parental chromosomes or their individual chromatids at the time of pairing.

1049. Eghis, S. A. 633.71:575.127.2:576.356.5
(Experiments on interspecific hybridization in the genus *Nicotiana*. III.)
Bull. Appl. Bot. Leningrad 1933: Ser. 2 (5): 77–125.

After a brief discussion of the theory that *Nicotiana tabacum* has originated from a hybrid of *N. sylvestris* x *N. tomentosa* by chromosome duplication, experiments are described in which a tetraploid hybrid of *N. tabacum* x *N. sylvestris* with 72 chromosomes was pollinated by *N. tomentosa* (24 chromosomes). A few viable seeds developed, though the reciprocal cross was entirely without success. Three hybrids were obtained, which displayed characters of the three species, very nearly equally pronounced. Very little pollen developed but what did was fertile, both in self-pollination and on *N. tabacum*. The hybrids were also fertile when pollinated with *N. tabacum*. The crosses with *N. tabacum* gave viable seeds and seedlings but the selfs produced a very reduced number of fertile seeds. This relatively high degree of fertility proves that the three species are very closely related.

The reduction division in the hybrids was quite normal in both first and second divisions and 24 chromosomes were invariably present at metaphase.

From these results it is concluded that *N. tabacum* contains two chromosome sets, one homologous with *N. sylvestris*, the other with *N. tomentosa*.

The fact that the fertility is not greater shews that the forms used in the present crosses are not those precise ones from which the original *N. tabacum* arose, or else that the three species have each evolved considerably since the origin of *N. tabacum* and that their degree of relationship has been gradually reduced.

Similar triple hybrids have been obtained by substituting *N. Rusbyi* for *N. tomentosa*, also *N. glutinosa*, though fertility in this case was not so high. These three species are closely related and are thought to have evolved from a common species.

From the distribution of the parental species it appears that *N. tabacum* has originated in South America and not in Mexico or the Antilles as has sometimes been supposed.

It is expected that the progeny of the triple hybrid will be very varied and shew new combinations of the specific characters, some of which may also be of practical value.

In the second part descriptions are given of a number of hybrids obtained from a cross of *N. tabacum* x *N. rustica* var. *colorata*, in which certain characters of the former species have been transferred to the latter, with simple Mendelian segregation in the F_2. The author points out that conjugation occurs in hybrids of these species and regards the transfer of characters as probably having arisen by an interchange of a small segment of two pairing chromosomes or possibly even of two whole chromosomes.

The third part contains an account of various triploid hybrids arising in crosses of *N. tabacum* by *N. glutinosa*, *N. tomentosa* and *N. sylvestris*, evidently by fertilization of an unreduced *tabacum* egg cell by normal pollen. The frequent occurrence of this phenomenon suggests the existence of genes in *N. tabacum* favouring non-reduction.

The triploid hybrids shewed a predominance of *tabacum* characters, though the one from *N. tomentosa* retained the short-day photoperiodism characteristic of the latter species.

The triploids were almost completely fertile. There were no univalents at meiosis, but only bivalents and trivalents. The slight excess of *sylvestris* or *tomentosa* chromosomes in the gametes evidently did not affect their viability, in contrast with the triploid *N. tabacum* where the pollen is largely infertile.

The progeny of these triploids contained a number of plants with 48 chromosomes; they possessed mainly *tabacum* characters but a few characters of the other species too, indicating

an interchange of certain *tabacum* chromosomes with those of the other species. By carrying out selfing on a very large scale, or better still by pollinating with one of the parental species, these triploids might be made a source of tetraploids and other forms representing new combinations of the specific characters and again of possible practical value.

1050. KOSTOFF, D. 633.71:575.127.2:576.356.5
(Polygenom hybrids experimentally produced.)
C. R. Acad. Sci. U.R.S.S. 1934 : No. 4 : Pp. 6.
By the union of an unreduced gamete of an interspecific hybrid with a normal gamete of one of the parental or a third species a hybrid containing three genoms is formed. A great many cases where this has occurred are enumerated. By a further repetition of the process polygenom hybrids can be produced and if the pure species is so chosen as to supply the genom only once represented in the interspecific trigenom hybrid a balanced amphidiploid may be built up, thus : AAB x B = AABB. Various hybrids of this type, together with other polygenom hybrids have been successfully produced.
The amphidiploids may or may not segregate, according to the parental forms used ; the fertile trigenom hybrids give very varied segregations.

1051. WHITAKER, T. H. 633.71:575.127.2:581.162.5
The occurrence of tumors on certain *Nicotiana* hybrids.
J. Arnold Arb. 1934 : **15** : 144–53.
Observations on F_1 hybrids of *N. glauca* x *N. Langsdorffii* shewed that the plants were in general intermediate between the parental species, possessed 21 chromosomes and were completely infertile. All plants formed tumours to a greater or lesser extent. Chromosome counts on 40 of the tumour cells shewed no evidence of polyploidy. From an examination of the other known cases of tumour formation in *Nicotiana* hybrids the author points out that they occur only when the 9-chromosome species are used as pollen parents and concludes that the introduction of the 9 chromosomes of these species is responsible for a cytoplasmic disturbance which leads directly to tumour formation

1052. KOSTOFF, D. 633.71:575.129:576.356
Cytogenetic studies of the triple fertile hybrid *Nicotiana tabacum* x (*N. sylvestris* x *N. Rusbyi*)—*N. triplex*.
Bull. Appl. Bot. Leningrad 1933 : Ser. 2 : (5) : 167–205.
This paper represents a cytogenetical study of the fertile triple hybrid named *N. triplex* already reported (see " Plant Breeding Abstracts," Vol. II, Abst. 118) with a view to the further investigation of the problem of the origin of *N. tabacum*.
A description is first given of the cytological behaviour of the pollen mother cells of the double hybrids from the crosses *N. tabacum* x *N. tomentosa*, *N. Rusbyi* x *N. tomentosa*, *N. tabacum* x *N. Rusbyi*, *N. sylvestris* x *N. Rusbyi* and *N. tabacum* x *N. sylvestris*. In the hybrids of the first cross, very few irregularities were observed at reduction division during the summer but in September when the temperature fell at night, gemini were not formed. This did not occur in pure species of *N. tabacum* and since according to Clausen's hypothesis half the genom of *N. tabacum* is the genom of *N. tomentosa*, this difference in reaction to low temperatures suggests that in fact they are not the same. Meiosis in the hybrid of *N. Rusbyi* x *N. tomentosa* is as regular as in pure species and morphologically and cytologically the two are more alike than some varieties and are clearly very closely related.
The low percentage of viable pollen in the hybrids of *N. tabacum* x *N. Rusbyi*, when if the *Rusbyi* genoms were identical with a half of the *tabacum* genoms the majority of the pollen grains should be viable, suggests a further dissimilarity between the genoms. Among the progeny obtained by pollinating *N. tabacum* with dyad pollen from the hybrid *N. sylvestris* x *N. Rusbyi*, were fully fertile intermediate *N. triplex* plants and partially fertile plants with a greater resemblance to one or other of the parent plants ; when cytologically examined the former had a perfectly regular reduction division while in the latter it was relatively irregular.

The resemblance of some of the plants to the parent species and their partial sterility is explained by an excess of one or two chromosomes due to non-disjunction or to division of the univalents. The occasional occurrence of one large and one small chromosome suggests a trivalent and a univalent and the possible significance of this is discussed, allosyndesis being the most probable explanation. In describing the F_2, F_3 and F_4 of *N. triplex* only the fertile, intermediate types are considered. There was a certain amount of variation among the F_2 and some in F_3. All the plants were fully fertile.

The behaviour of the segregates of *N. triplex* when crossed with *N. tabacum*, *N. sylvestris*, *N. rustica* and *N. Rusbyi* was very different and it is assumed that the genoms of *N. sylvestris* and *N. Rusbyi* do not behave " physiogenetically " like the *tabacum* genom.

Backcrosses between *N. triplex* and *N. sylvestris*, *N. Rusbyi* and *N. tabacum* are described in some detail. The occurrence of complexes of chromosomes, probably trivalents, was frequently observed during the first meiotic division and a corresponding decrease in the number of chromosomes, which increased again as meiosis proceeded. The possible constitution of these trivalents is discussed.

The cytological investigation of the backcrosses shews that the behaviour of *N. triplex* in crosses is not like that of *N. tabacum*. Parthenogenesis took place when *N. triplex* was pollinated by *N. Langsdorffii* and *Petunia violacea*.

From the data given a number of objections are advanced against Clausen's hypothesis for the origin of *N. tabacum* and it is suggested that changes such as gene mutation, etc., have so altered the genom of *N. tabacum* that it can no longer be identified with the genoms of the species from which it arose or that the original types have since died out.

The formation of triple hybrids offers a promising method for the study of experimental evolution and in this connexion the significance of a synthetic as well as mutative origin as factors in evolution is discussed.

1053. RAVE, L. 633.71:575.14
" Heterosis " beim Tabak. **(Heterosis in tobacco.)**
Züchter 1934 : **6** : 25–30.

The practical value of the effect of heterosis in F_1 hybrids has already been recognized and utilized but the further possibility of retaining the effect in succeeding generations requires investigation. Tables are given of crosses between German varieties in one case and between German and foreign varieties in the other, shewing the fresh and dry yield of the F_1 and F_4 of the hybrids and their parents.

Of the hybrids of 7 crosses made between German varieties, only three which included Amersfoorter as one of the parents, shewed an increase in yield above that of both parents which was maintained in the F_4. Heterosis was more marked in the crosses between German and foreign varieties.

The cross between Samsun Dere, a small leaved cigarette tobacco with 20–24 leaves and Calcar, a large leaved variety with at least five leaves fewer than Samsun Dere, is of special interest to breeders as the progeny shewed a constantly increased leaf number up to as many as 40, while still retaining the size and shape of the small leaved variety, the effect of Calcar being solely to increase the number of leaves.

These results are discussed in the light of the theories of heterosis advanced by Kappert, East and Jones.

1054. 633.71:576.16
GOODSPEED, T. H. 633.71:576.312.35
Notes on *Nicotiana tomentosiformis* (n. sp.) and *N. wigandioides* K. Koch and Fint.
Ostenia, Montevideo 1933 : 309–14.

Taxonomic descriptions and observations on *N. tomentosiformis* (n. sp.) and *N. wigandioides* K. Koch and Fint and their geographical origins are given.

The diploid chromosome number in the *tomentosa* group is 24.

The striking resemblance of hybrids recently obtained from a cross between *N. tomentosa* and a race of *N. glutinosa* from the wild state to *N. wigandioides* indicates that the last named species

had its origin in a hybrid between the progenitors of modern *N. tomentosa* and *N. glutinosa*. Cytogenetic and cyto-taxonomic features of the *tomentosa* group and hybrids between its members will be discussed in a subsequent report.

1055. BRIEGER, F. 633.71:576.354.4:576.354.46
Ablauf der Meiose bei völliger Asyndese. (**Progress of meiosis in cases of complete asyndesis.**)
Ber. deuts. bot. Ges. 1934 : **52** : 149–53.

An account of preliminary investigations on meiosis in a number of "autohaploid" and "allopolyploid" hybrids of tobacco. In general either 24, 36 or 48 univalents were found with only occasional instances of bivalents; and the course of the division, which is clearly described, was similar in all three types of asyndetic hybrids. The most striking features were the elongation and terminal flattening of the spindle which are followed by the development of a characteristic bend in the middle and a resumption of a tapering appearance at the poles again. In the accompanying behaviour of the chromosomes a general tendency was observed for them normally to migrate to the spindle poles as far as possible from the equatorial zone, so that at the hour-glass stage of the spindle they are ranged partly in annular zones round the poles.

The interpretation of the results and its relation to previous work on the subject and to investigations in progress is deferred.

1056. 633.71:576.356.52
WEBBER, J. M. 633.71:576.356.5:575.255
Cytological features of *Nicotiana glutinosa* haplonts.
J. Agric. Res. 1933 : **47** : 845–67.

Three haplonts of *N. glutinosa* (n = 12), two (probably parthenogenetic) from X-rayed seed derived from parents selected for low vigour and fertility, and one of apparently spontaneous origin, were found to be self-sterile and produced no seed on pollination with diplont pollen. The chromosome morphology in haplont and diplont forms is described in detail. Diploidy occurred frequently in the root systems of *N. glutinosa* haplonts and was very similar in extent and nature to that found in haplonts of *N. tabacum*, *Crepis capillaris* and *Lycopersicum esculentum*. It would appear that diploidy in haplont roots is less frequent than is commonly believed and also that it is no more frequent than tetraploidy in diploid roots. It is suggested that the frequency of 2n and 4n roots is determined by growth rate relations in the tissues and that diploidy in haplont roots is probably due to the effect of frequent and sudden environmental changes on poorly protected meristematic tissue. The latter possibility is also tentatively considered as an explanation of the less frequent occurrence of polyploidy in shoots as compared with roots. Chromosome doubling in the root tips is possibly due to failure of anaphase separation, following retention of the nucleolus to this stage, with ultimate formation of a single nuclear membrane about the entire diploid chromosome group. In callus tissue doubling may perhaps be attributed to fusion of the nuclei of bi-nucleate cells.

Meiotic and gametophytic behaviour is very irregular and resembles that of other haplonts, especially in *Nicotiana*; a number of new features are enumerated.

Numerous plates and drawings illustrate the data.

1057. 633.71:581.162.5:581.331.23
EAST, E. M. 633.71:575.113.3:581.162.5
Norms of pollen-tube growth in incompatible matings of self-sterile plants.
Proc. Nat. Acad. Sci. Wash. 1934 : **20** : 225–30.

The material for this study was collected by selfing a complete series of homozygotes for the various sterility S allelomorphs in union with S_1.

At least 100,000 selfings were made and the resulting families could be classed in 5 groups according to their capsule production from pollination of the open flower or the bud and containing different combinations of the S allelomorphs. No seeds were ever obtained from selfing S_1S_4, S_4S_4 or S_5S_6 plants.

The observations shewed that in plants homozygous for the various S factors S_1S_1—$S_{15}S_{15}$ each allelomorph exhibits a specific norm for pollen tube growth. The growth rate norm is influenced only slightly by the type of gene in any chromosome other than that carrying S. Similarly temperature, and within normal limits, the period of day-light or the stage of the life cycle at which pollination was effected, had in general no detectable effect on the growth rate of the pollen tubes.

It is thought that the existence of specific norms depends not on a simple quantitative relationship among the genes involved, but on a nutritional basis to some extent and upon some mechanism resembling immunological specific protein reactions; for certain allelomorphs when homozygous cause similar growth rates following selfing, whereas in cross matings the growth rates of the tubes are tremendously accelerated.

Finally, it was noted that a normally slow growing allelomorph was speeded up by the presence of a fast one in matings where both are incompatible. The immediate cause of the acceleration effect is regarded as being probably due to interference with the specific incompatibility reaction rather than with the general nutritive reaction.

1058. WELLENSIEK, S. J. 633.72:575.42
De practische uitvoering van theeselectie. (**The practice of tea selection.**)
Bergcultures 1933: **7**: 1270–77.

Selection for yield, which forms the main subject of this paper, is based on a comparison in plot tests of selected plants and their progeny with the particular standard type.

In the initial selection in the nursery the most vigorous plants are chosen, those in which the aerial portions appear to the eye to weigh the most being regarded as the best. If preferred, stem diameter or root development, also determined by visual inspection, may serve as criteria. Twenty per cent was adopted as the minimum yield in selection. The elimination of not altogether valueless older seedlings may be counteracted by an initial selection of the seed that sinks in a 25 per cent sugar solution. Also the nursery can be sown very densely and thinned out at an early stage. This method of very early selection in the nursery can be provisionally recommended.

In order to ensure a high degree of "efficiency" (*i.e.*, as little variation as possible) in the plucking gardens, after the superior plants have been selected by visual inspection for large plucking surface, a dense stand, brightness and suppleness of leaf, also leaf size, hairy peko and if possible rapid growth, the best plants should be plucked individually to determine their yield. About 6 rounds should give the requisite degree of accuracy for this test. Rapidity of growth can be estimated by eye in recently pruned gardens, otherwise it can only be inferred from the vigour of the original seedlings. The actual method of carrying out selection in the plucking garden is described. Border plants should not be included in the plucking tests. The plants finally selected as mother trees should yield at least three times the average yield from the whole garden.

The selected plants must be propagated by budding, the Forkert method being recommended; the buddings obtained could, it is suggested, then be individually tested by planting them out together in replicated rows to ascertain the value of the clones derived from the selected mother plants. For this test 2–2½ years should suffice.

The various ways in which selected buddings from proved clones and from the nursery stumps may be profitably utilized are considered.

A provisional 4-year scheme is outlined of the procedure in the selection of clones to be used for grafting in plucking gardens and for establishing a seed plot.

1059. HOEDT, TH. G. E. 633.72:581.13:575
Mededeelingen over plantkundig onderzoek bij thee. (**On botanical investigations of the tea plant.**)
Bergcultures 1933: **7**: 1419–24.

Among the factors most intimately connected with the internal quality of tea are the properties of the initial material, the green leaf. For this reason the function of the assimilation of carbon compounds in the leaf is examined. The evidence tends to shew that leaves rich in products

of assimilation (and especially starch) produce a superior quality of beverage. This fact opens up possibilities for improving tea by attention to cultural methods such as late or early hour of plucking and may possibly also be of importance in the selection of clones ; for the individual differences found in plants as regards carbohydrate production should also be reflected in the clones. It is therefore quite possible that it might be advantageous to select clones with an active assimilating capacity and thus adapted to produce high quality tea in countries with little sunlight.
A possible relation between *Helopeltis* attack and starch reserves is touched on and the need for further study of the assimilative processes in tea and the anatomy and physiology of the tea plant is emphasized.

1060. LAMBERS, M. HILLE RIS 633.73:575(92.2)
Gegevens over koffiekruisingen op Soember Asin. (**Data on crosses of coffee at Soember Asin.**)
Bergcultures 1933 : **7** : 1409–17.
A report is presented on crosses of *arabica* and *robusta* types, *congensis* and *arabica* and *arabica* with *uganda* and finally *robusta* forms *inter se*. Selfings were also carried out and where possible reciprocal crosses.
The aim of the *arabica* x *robusta* crosses was to obtain an improvement on the *robusta* quality, superior resistance to leaf disease and a greater tolerance for altitudes higher or lower than those most suited to the two parent types respectively.
The technique of artificial crossing is described.
Selfing of *robusta* yielded very few berries, whereas cross-pollinated branches sometimes bore more fruits than all the rest of the plant. *Arabica* selfed gave a normal set and so did cross-pollination but in the latter case endosperm development was frequently very defective, though the embyros ultimately developed slowly into normal plants.
The progeny of the cross were typical *arabica–robusta* hybrids, markedly more resistant to *Hemileia* and much more vigorous in growth and development than pure *arabica* forms. On the other hand the yield was poor and the berries mostly rotten. One hybrid, however, Arla I (*arabica* x *Laurentii*) gave a higher yield of berries than usual for *arabica*, and much fewer rotten ones. It is being used for further crossing *inter alia* with *robusta* and for selection.
The *robusta* crosses *inter se* provided interesting evidence in various reciprocal pollinations of the accumulation in the progeny of certain anomalies present in the selfed progeny of the two parents.
A number of crosses and series of crosses of a mother plant with various male parents, and the effect of the male parents in improving or deteriorating the progeny are described. The cross SA 24 x 113 yielded six good mother plants for future selection work. A study (by a method which is recommended for future use) of rapidity of growth in a number of crosses and selfings demonstrated the superiority of crosses of SA 56 x 109 and PB 42 x SA 109, which is attributed to the growth capacity of SA 109. Though the actual productivity could not be determined at present, some information is given about the relative rate at which the productive stage is reached by various hybrids.
This year the first crosses between good specimens from the first artificial *robusta* crosses will be made.

1061. 633.74(81)
Cultura do cacáo (Monographia elaborada pelo Serviço de Inspecção e Fomento Agricolas.) [**Cultivation of cacao. (Monograph prepared by the Service of Agricultural Inspection and Development.)**]
Min. Agric. Ind. and Comm. Rio de Janeiro 1930 : Pp. 50.
A manual, written in popular language, on cacao cultivation in Brazil. Amongst more general questions, the character of the plant is described. In Brazil three species are cultivated, *viz.*, *Theobroma cacao*, *T. speciosum* and *T. microcarpum*. The first goes by the name " cacao commum," the second " cacao de Pará." The " cacao do Maranhão " is another variety of this species.

1062. 633.74:576.42
633.912:576.42
633.72:576.42
633.73:576.42

OSTENDORF, F. W.

Over selectie, in het bijzonder van cacao. (**On selection with special reference to cacao.**)

Bergcultures 1933 : 7 : 1297–302.

This paper contains a discussion on the choice of initial material for mother trees and the various stages of continued selection of the subsequent progeny with reference to rubber, tea, coffee and, in particular, cacao. Attention is drawn to the fundamental differences in the methods of selection to be applied to these four crops, owing to the different ultimate aims of the grower (*e.g.*, for rubber, high yield, and for tea, quality) and the different degrees of homogeneity in the original forms in cultivation.

The systematic relationships and nomenclature of the various species and cultivated forms of cacao are discussed at some length and the author inclines to the view that the cultivated forms of cacao are derived from at least two botanical species, one the typical Criollo type and the other one (or more) species must be represented by the very common Calabacillo forms ; while the remaining Forastero types then represent hybrid types derived from crosses of the above two species.

In the initial selection of plants from which to obtain mother trees with the desired characteristics, it is inadvisable to make the standard too severe, and thus possibly exclude material that might have yielded very valuable progeny ; only a few of the most important characteristics should be regarded as indispensable and the rest should be selected for negatively, *i.e.*, a tree should be rejected only when one of these points is particularly poor or several of them together might tend to produce an inferior type.

Yield forms the main aim in the initial selection of tea, rubber and coffee, though in the case of the last named crop a qualitative factor too is introduced, *viz.*, bean size, while in the case of cacao yield has been a secondary matter as compared with good quality as represented by uniform, well filled large nuts of suitable shape, and with a smooth surface indicating resistance to moths. Later on selection for high yield was introduced.

The two different types of difficulties for breeders, arising respectively from genetic and physiological association of desirable with undesirable characteristics are mentioned with reference to the author's investigations in progress on a possible relationship between the occurrence in cacao of pigmentary substances in the tissues and growth capacity.

A further point to be considered in the selection of mother trees is the period in the life time at which the yield record is taken ; and early maturing trees should be chosen not only for their economic value but also because earliness actually facilitates selection in each generation at an early stage of development. Also mother trees should be selected during the stage representing the rise in their production curves, otherwise apparently disappointing results may be obtained in records taken during early years for late maturing progeny. This has been found to hold for rubber and coffee. For cacao it is recommended that selection should be based on the records covering about the seventh to tenth year : the performance of the mother tree can then always be observed in later years too while the progeny are maturing.

The prevailing methods of selecting mother trees of the various crops are mentioned and the procedure recommended for cacao is to select in the first instance, systematically from the whole plantation by visual inspection, then from this first lot to estimate the number of nuts a few times per year and finally after that to harvest the crop individually from the best trees.

In testing the sexual progeny of the mother trees open pollination may be used, or controlled pollination, either by crossing or by selfing, self-pollination being preferable where possible. As a rule open pollination has so far been the method of reproduction used in the test plots of cacao ; for this reason slight differences in the average production of the various families must be disregarded.

Brief comments on the results achieved by systematic selection of coffee, rubber and cacao conclude the paper.

In this ensuing discussion the superior yields recently obtained from suitable mixed clones of coffee as compared with monoclone culture was emphasized.

1063. VESSELOVSKAYA, M. 633.75
(The poppy, its classification and its importance as an oleiferous crop.)
Suppl. 56, Bull. Appl. Bot. Leningrad 1933: Pp. 213 + XXII.

A collection consisting of 1,600 specimens has formed the basis of the present investigation, involving types grown in the U.S.S.R. and West European countries, together with material collected by expeditions to a variety of countries in the near and far East. These expeditions have revealed a much greater ecological diversity than has hitherto been suspected. Observations were also made on the extent of variation in morphological characters and in yield and oil content.

The history of poppy cultivation is traced from the time of the Swiss lake dwellings up to the present day. For each character in turn the degree and nature of variation are indicated, reference being made to the localities in which the different forms are found and to the available literature on the inheritance of the characters in question. The characters of the stem, leaf, flower, capsule and seeds are treated in this way, followed by biological characters such as growth period, and their behaviour when grown in different localities of the U.S.S.R. and commercial characters such as oil content.

From these studies it is possible to arrange the forms in definite ecological or geographical groups, the main characteristics of which are described. The cultivated forms are divided into 7 groups and the weed forms into 3, one of the main distinguishing features of the groups being the photoperiod.

The classification is then dealt with in detail, keys being provided for the determination of the groups, subgroups and varieties, followed by descriptions of each of these in turn.

The wild poppies present a multiplicity of characters equal to that of the cultivated forms, the latter being distinguished by certain characters whose persistence would be impossible in the wild state, *e.g.*, closed capsules. There is a continuous gradation from cultivated to wild forms and the authoress concludes that the former have originated through man's agency by selection from the latter. The close relationship between the wild species *Papaver setigerum* and the cultivated *P. somniferum* was demonstrated by the production of fertile F_1 and F_2 hybrids between the two, which crosses illustrated the dominant nature of most of the characters of *P. setigerum*. The chromosome number 44 for *P. setigerum*, as opposed to 22 for *P. somniferum*, prevents their being classed together as one species but relics of the species from which they have both presumably evolved are found among certain Mediterranean wild poppies and in the form of half-wild plants frequently to be found in *P. somniferum*.

The greatest number and variety of characters and the highest proportion of dominant genes were found among the European poppies. This with the evidence on historical, linguistic and other grounds combines to indicate that the European Mediterranean countries have witnessed the origin of the poppy.

In experiments on the floral biology, the stigma of both the cultivated and wild poppies examined was receptive from 1–5 days before, until the fourth day after the opening of the flower. The entry of pollen grains was observed in flower buds fixed before opening, thus illustrating the possibility of self-pollination before the flower opens. Pollen was retained for 10 days and longer without entirely losing its viability. Flowers allowed to self-pollinate naturally and flowers artificially selfed produced the same amount of seed, provided the quantity of pollen applied in the latter case was sufficient. No adverse effect of inbreeding was observed and both recessive and dominant plants allowed to open-pollinate usually bred true.

The first steps in breeding are to be the production of pure lines adapted to different regions and characterized by high yield and oil content, and non-shedding capsules. The light-seeded forms have proved to be the highest oil producers, those with a large number of well-developed septa in the capsule the best yielders, but the desirability of producing branched or unbranched forms is a point which still awaits decision. Other desirable features are uniform ripening and resistance to *Peronospora arborescens* and other diseases.

1064. GUNKO, G. K. 633.81:575
(The breeding of essential oil plants.)
Bull. Appl. Bot. Leningrad 1933: Ser. A (8): 27–42.

No less than 300 species, belonging to 26 different families, are used for aromatic oils; each one occupies an extremely small area and hence the paucity of botanical and agricultural work that has been devoted to them.

For many aromatic plants it has been found that races from various countries differ sharply in their essential oil content; figures are quoted in illustration of this. Original experimental data are presented which shew that the essential oil content and quality of a number of clones of lavender were the same when grown in widely separated areas differing in altitude and ecological conditions. The differences then are apparently racial and not environmental. The variation of percentage and quality of the oil with altitude in the Alps is further shewn to be largely due to the overlapping of the zone of *Lavandula vera* from above with *L. spica* from below, the latter species being characterized by higher oil content but lower quality.

In 1927 breeding work with aromatic plants was started by the Institute of Plant Industry. Single plant selection of peppermint produced lines varying in all the main characters. The extreme differences observed for the following characters are tabulated: time and flowering, height of plant, ratio of stem weight to leaf weight, total and percentage oil content. Observations of a similar nature are reported for coriander, aniseed, fennel and lavender. The percentage of essential oil in fennel varied from 2.23 to 13.02 for instance and all the figures prove that there is great scope for selection and breeding in these plants.

Considerable improvement has already been effected in the aromatic plants cultivated in the Soviet Union by introduction from abroad followed by selection. Numbers of new aromatic plants have also been found among the local wild flora.

There are indications from biochemical researches that though the proportion of different components may vary within a species, the actual components produced by a given species are fixed. In this case breeding for a new component or active principle will only be possible by means of interspecific hybridization and not by work within the species. Many of the most valued aromatic plants have in fact recently been shewn to be chance interspecific hybrids. The lines on which breeding should be carried out will vary for the different groups of plants. Some of the main points to be borne in mind are indicated for the various groups. Two essentials are the provision of proper standards of comparison and the execution of the work on a co-operative basis, physiological, biochemical and other studies being carried out side-by-side with those of a botanical and genetical nature.

1065. PIL'CEVSKII, A. I. 633.811.557
(Essential oil plants of Ukraine.)
Bull. Appl. Bot. Leningrad 1933: Ser. A (8): P. 216.

The expedition to Ukraine has discovered among others, a large tract of *Azalea pontica*, which contains an essential oil of great potency and great economic value; the extract has been valued at 300 gold roubles a kg. The species is confined to Ukraine with the exception of a few which occur in Switzerland.

1066. 633.812
DUCELLIER, L. 633.812:575.127.2
Observations sur la descendance du Géranium Rosat. **(Observations on the ancestry of *Geranium* Rosat.)**
Bull. Soc. Hist. Nat. Afr. 1933: **24**: 142–48.

The views of various investigators on the hybrid origin of *Pelargonium roseum* are stated.

The writer's experiments on *Geranium* Rosat would seem to indicate that it is a self-sterile, interspecific hybrid. Seed was, however, obtained from two plants and from a study of the extreme variation of their progeny and the absence of Mendelian ratios these two plants are assumed to be the result of natural crosses *P. grandiflorum* x *G.* Rosat and *P. ficifolium* x *G.* Rosat. The readiness with which certain *Pelargonium* species intercross naturally is regarded as the

probable cause of the marked polymorphism among *Pelargonium* varieties. A further study is to be made of the essential oil from certain of the hybrids investigated.

1067. Holmes, F. O. 633.842–2.8–1.521.6:575
A genetic factor for localization of tobacco-mosaic virus in *Capsicum*.
Science 1934 : **79** : p. 374. (Abst.).
Most common varieties of *Capsicum frutescens* L. on inoculation with tobacco-mosaic virus develop a systemic infection resulting in stunting, mottled leaves and reduced yield of fruits. The Tabasco pepper and a few other varieties are able to localize the virus and thus do not exhibit a systematic infection. This localizing capacity is due to a single Mendelian factor which is apparently uninfluenced by other factors or factor combinations so far observed. Though no morphological character has been found constantly associated with the localizing ability, hybridization has yielded peppers with immunity to systematic tobacco-mosaic as well as large fruits and other desirable qualities.

OIL PLANTS 633.85

1068. Nohara, S. 633.853.74:575.1
Genetical studies on *Sesamum indicum* L.
J. Coll. Agric., Tokyo Imp. Univ. 1933 : **12** : 228–386.
This voluminous paper summarizes the results of 21 years' work. Details are given of the inheritance of a large number of characters, only the more important of which can be mentioned here. *Sesamum indicum* is of doubtful origin, probably the East Indies, and has been in cultivation from very early times. Three major forms are recognized, here termed Type I with white seed, Type II with black seed and Type III with brown seed. The plant is entomophilous and artificial aid was used to secure self-pollination.
Fasciation is a common phenomenon and of economic importance. It occurs only in Type II. It is a very variable character and its expression sometimes so slight as to be difficult to determine. Crosses between Types I and fasciated examples of Type II are described and it is concluded that two independent factors, either of which is capable of producing fasciation, are involved. Normal is, in both cases, dominant. The results are discussed in relation to other work on fasciated plants. From this it is concluded that the observed excess of normal (dominants) is partly due to reverse mutation and partly to difficulty in diagnosis.
Type I has a branching habit while Types II and III are almost devoid of branches. There is here a single factor difference though confusion may arise from the supression of branches in Type I when overcrowded. The heterozygote is intermediate.
Colour of the seed is complicated by the fact that the white colour is due to the presence of crystals of calcium oxalate in the epidermal cells of the testa. The brown colour is due to a thickening of the inner half of the radial walls of the epidermis, the thickening, supplemented by pigment deposition in the cell, carrying the colour ; the black colour is due to a deposition of pigment within the epidermal cells which is superimposed on the brown colour of the thickened walls. These radial thickenings and the presence of crystals of calcium oxalate are respectively the dominant and recessive expressions of a single factor difference. When the crystals are removed, the colour of the white form is pale pinkish buff to cinnamon and to this colour brown is dominant, while black is dominant to both white and brown. Black and brown are each developed by two independent factors (B_1B_2 and C_1C_2 respectively).
Date of maturity appears to be controlled by an undetermined number of factors, the F_1 being intermediate and approaching the late parent while the F_2 presents a monomodal curve.
Other characters considered, though in relatively small populations, are compoundness of leaf, hair characters, leaf-axil nectar glands, corolla lips and colour, number of cells in the ovary, seed measurements, character of seed coat and quality of oil. Evidence is adduced for linkage between the genes influencing the formation of crystals of calcium oxalate and seed length. H. M. L.

1069. Beirnaert, A. 633.855.34:575.42
La sélection du palmier à huile. (**The selection of the oil palm.**)
Bull. Agric. Congo Belge 1933 : **24** : 359–80.

The aims of selection are to improve the type of fruit and to improve the productivity of the bunches.

The productivity of the palm is the result of the environment on the inherited characters ; hence if, from a group of palms grown under as uniform conditions as possible, the best types are selected, these will pass on their qualities, at least in part, to their descendants.

Although there are practically no data concerning the inheritance of the characters of the palm, from analogy with other plants it is probable that yield is determined genetically by a group, more or less large, of cumulative factors.

In choosing the mother trees it is essential that a large number should be available. If, for example, five pairs of allelomorphs determine a good yield, then the homozygote may be expected once in every 1,024 plants and practice confirms these figures. With regard to the greatest absolute weight of pericarp, this in the Tenera type occurs in the proportion 1 : 50. The conditions at Yangambi are particularly favourable for such selection as there are 30,000 palms under observation.

The observations on yield must allow for the very variable periodicity exhibited by the palms. Palms growing under specially favourable conditions are discarded. A large number of bunches is a better character than a few heavy bunches, as the latter often indicates a low reproductive capacity and is probably, though not always, the result of the environment.

The yield of palms of equal productivity may be due to different factors and the combination of these into one type represents the ideal of the breeder. The number of factors is probably so large that the hope of finding the type in nature is negligible.

After a theoretical discussion of the value of the various possible crosses it is concluded that the best combination is one in which the characters of the parents are complementary and of good average value and that only those of the progeny which have sufficiently high values for each of the three characters, number of bunches, number of flowers and size of fruit need be selfed. From a consideration of the number of factors involved 150–200 individuals from each cross are regarded as the minimum from which to obtain the required combinations. With an increasing number of mother trees and of crosses made, the chances of recovering the homozygote of the desired type are proportionally increased.

At the Yangambi Station there are 100 mother trees combining high yield with a high percentage of pericarp, which will give 700–800 F_1 plants for selection.

A comparison of the distribution of the character absolute weight of pericarp in Tenera and Dura types shews that there is considerable variation and that while a larger number of Tenera palms have a high weight of pericarp there are also a small number of Dura types with a high weight which are of value for selection. Types with less than 2 mm. of shell are unsuitable for industrial reasons.

Size of fruit alone may be an acquired character and as such not inherited, but when united to high percentage of pericarp it is a valuable criterion, and in combination with large numbers of fruits or bunches may be heritable.

A type known as the Yangambi shews a marked uniformity of their fruits which give 12–18 gr. of pericarp and are ovoid in shape or sometimes elongated. The outside fruits weigh on the average 16–22 gr.

The ideal type is therefore that which combines a large number of bunches, large number of flowers per bunch, great thickness of pericarp, very large kernel and an elongated fruit.

1070. Beirnaert, A. 633.855.34:575.42
La sélection du palmier à huile. (**Selection of the oil palm.**)
Bull. Agric. Congo Belge 1933 : **24** : 418–58.

Preliminary results of selection of the oil palm at the selection station at Yangambi.

Three plantations are under observation. The oldest, de la Rive, was planted in 1922 from the seed of 10 bunches from Djongo d'Eala and Yawenda. All of these except one were of the

Mohei type. Of the 1,880 palms planted in 1922 only 563 remained at the beginning of 1931, the others were eliminated on account of a too thick shell. Further selective observations mainly on productivity reduced the number in this plot to 170. As a result the remaining palms are not being grown under the best conditions so that if their yield is now good, under favourable conditions it should be considerably better.
Other plantations started in 1924, 1927, 1929 and 1930, all of the Mohei type, are under observation, two comprising more than 18,000 palms.
In the choice of mother trees, the final aim of this selection, such trees must have fruits with more than 3 mm. of pericarp. Then after one years' observation (at 6–7 years) the bunches of those trees which have given 100 kg. of bunches and which possess a good crown well supplied with unripe bunches and female inflorescences (7–8) are subjected to a thorough analysis. Some of these trees are artificially pollinated which may give a gain of two years in the production of a controlled F_1.
After two years observation all those trees are eliminated which have given less than 60 kg. of bunches per annum and more artificial pollinations are made.
After three years observations a provisional selection of mother trees is made. These should have had an annual average of 140 kg. of bunches during 3 years, 75 per cent of pericarp, outermost fruit with an average weight of more than 12 g., a nut weighing more than 1 g., an annual average yield of 33 kg. of oil and should give as far as possible a guarantee that these characters will be inherited and are not the result of favourable conditions. A mother tree is only considered as definitely selected when it has given a satisfactory progeny. An analysis is given of the factors modifying the number of flowers per bunch, the weight of fruit and the number of bunches. As a result it was found that the number of bunches is less influenced by the conditions of the development of the palm than the other two characters.
Of the 22 mother trees which are described, 16 originated from Djongo d'Eala and the rest from 4 palms of Yawenda.
As lack of space prevents all possible crosses from being made, 3 or 4 of the most interesting are chosen and 150 individuals from each cross are planted in 1 hectare. Other crosses are also made but only 50 individuals are planted from each cross and only a third of a hectare is needed.
The progeny are distributed for purposes of investigation among genealogical plots and cultural plots. The aim of the former is a comparative test of the progeny in order to determine the genotypic value and the value for hybridization of each mother tree, to make observations under strictly comparable conditions which will allow of a choice of mother trees of the first generation and to create an isolated block for other plantations where seed can be produced in quantity.
In the experimental plots comparative tests are made of different soils, cover crops, manures, time of harvesting, etc. The palms in the experimental plots are also used for genetical observations and the selection of F_1 mother trees.
A list is given of the crosses made during 1929–33. Enormous numbers of seedlings have already been planted from these crosses.

PIGMENT PLANTS 633.86

1071. NEKRASOVA, V. L. 633.862.9:581.9
(*Commelina communis* **L. its geographical distribution and utilization.**)
Bull. Jard. Acad. Sci. L'URSS. 1932: **30**: 659–68.
There are various indications that the plant can be used for producing a blue dye, for food and in medicine and the utilization of the plant, hitherto regarded as a noxious weed, is to be subjected to further study.
The genus is shewn to have three centres of distribution, the main one in Africa, others in Australasia and America. A brief account is given of the distribution of the species, with special reference to the U.S.S.R.

TANNING PLANTS 633.87

1072. Novopokrovsky, I. V., Vesselovsky, V. P. and Gussev, V. P. 633.871(47.9)
(Report of the expedition having investigated the conditions of growth and cultivation of the Scumpia in the northern Caucasus.)
Bull. Appl. Bot. Leningrad 1933: Ser. 10 (1): 97–126.
A full report of the investigation of the wild specimens of *Rhus cotinus* L. (*Cotinus Coggygria* Miller), which were found to belong to three varieties, *levis*, *sublevis* and *pubescens*, the latter having the highest tannin content.

1073. Ross, H. 633.879–2.53
Über nicht parasitäre Hexenbesen an *Robinia pseudacacia* L. **(On non-parasitic witchesbrooms on *Robinia pseudacacia* L.)**
Ber. deuts. bot. Ges. 1933: 51: 292–300.
It is suggested that the witches brooms in question may perhaps have originated as a result of bud variation, due to specially abundant nutrition.

MEDICINAL PLANTS 633.88

1074. Girola, C. D. 633.885.1(82)
Contribución al estudio del cultivo de las quinas (*Cinchona officinalis* et sp.) y a su experimentación en la República Argentina. **[Contribution to the study of cinchona (*Cinchona officinalis* et sp.) cultivation and experimentation on it in the Argentine.)]**
Bol. Minist. Agric. B. Aires 1933: 33: 227–43.
A brief résumé is given of the history of cinchona followed by descriptions of the main species and varieties of the methods of cultivation and of utilization. For Argentine conditions it is recommended that *Cinchona succirubra* be planted and it is thought probable that by adequate selection the alkaloid content could be raised as it has been in *C. Ledgeriana*.

1075. Kreier, G. 633.885.1(92.2)
(Cultivation of cinchona tree in Java.)
Soviet Subtropics 1932: 4th year ed. No. 3 (13): 76–80.
Reference to article by M. Kerbosch in "Proceedings of Celebration of the 300th Anniversary of the First Recognized Use of Cinchona," at the Missouri Botanic Garden 1930 (see "Plant Breeding Abstracts," Vol. II, Abst. 290).

RUBBER PLANTS 633.9

1076. 633.913:575.127.2:576.356
Botschanzewa, S. 633.913:581.162
(The biology of flowering in guayule, *Parthenium argentatum* Gray.)
Acta Univ. Asiae Mediae Ser. VIII–b. Botanica 1933: Fasc. 15: Pp. 16.
The microspore mother cell development was examined in a number of forms of guayule and other species of *Parthenium*. In nearly all of them the archesporeal cells degenerated at an early stage, and chromosome counts gave varying results. The authoress concludes however that the chromosome number for *P. argentatum*=36 and for *P. incanum*=18. The passage of the chromosomes to the poles was highly irregular and very few regular pollen grains were formed. This irregularity is taken as an indication that the forms examined are the result of hybridization with *P. incanum*. The form of *P. argentatum* in which the irregularities were least pronounced was the variety *angustifolia* and this is regarded as nearest therefore to the pure type originally introduced from America. The comparative uniformity of the plants is probably accounted for by the sterility of all gametes with aberrant chromosome numbers.
Various irregularities of the pollen grains are described. All attempts at obtaining artificial germination of the pollen were unsuccessful.

In view of the differences of opinion in the literature on the method of pollination of guayule, further experiments on this point were conducted. The methods of emasculation and isolation are described. Hardly any pollen appeared on detector slides exposed for several days and this and other facts lead to the conclusion that guayule is insect-pollinated.
On fifty isolated inflorescences of two races of *P. argentatum* v. *patens* no seeds developed. Neither did seeds develop from artificially self-pollinated inflorescences. Pollination from one inflorescence to another of the same bush gave 6–22 per cent germinating seeds, varying in different bushes. Pollination from another bush of the same race gave in one race 35 per cent germinating seeds, in another 5 per cent. A race with irregular meiosis was pollinated by one with fairly regular meiosis and 39 per cent good seeds were produced, in the reciprocal cross only 15 per cent. The conclusion reached is that the species is largely cross-pollinated.
Crosses of a form of *P. argentatum* with regular division by *P. incanum* gave 2 per cent seeds, when the guayule was female, 5·5 per cent when the guayule was male, whilst a form with irregular division crossed with *P. incanum* gave 17·5 per cent. The fact that the cross succeeds and that the forms with irregular meiosis cross most easily is a further indication that these forms are interspecific hybrids with *P. incanum*.

NUTS AND FRUIT TREES 634

1077. Ivanov, N. N., Burkin, V. N., Borokhovich, B. O. and Povolotskaya, K. L. 634:577.16 635:577.16
(The presence of the anti-scurvy vitamine in the various fruits, small fruits and vegetables.)
Bull. Appl. Bot. Leningrad 1933 : Ser. A (8) : 95–111.
The vitamin C content of a number of standard varieties of various fruits and vegetables was investigated. Quite marked varietal differences were observed.

1078. 634.11 Present van Holland
634.11 Present van Friesland
Lijsten, R. 634.11 Anna Boelens
Drie nieuwe vruchten. **(Three new fruits.)**
Fruitteelt 1934 : **24** : 65–69.
Descriptions of the origin and characteristics of three new varieties of apple seedlings, Present van Holland, Present van Friesland and Anna Boelens, recently officially approved for use by Dutch growers.

1079. Boot, G. 634.11 Willem Balk
Appel "Willem Balk." **(The Willem Balk apple.)**
Fruitteelt 1934 : **24** : 27–29.
This first class dessert apple arose as a seedling obtained from the variety Present van Engeland. The variety yields well and early, ripening first at the time when apples are somewhat scarce on the market.
Repeated tests of the colour, flavour and other characteristics of the fruit ultimately shewed that when harvested at the right time these qualities, and the flavour especially, were excellent. The keeping quality is also good and the prolificacy and the general characters of the tree and its freedom from disease are highly commended.

1080. 634.11:581.162.5:576.356.5
Veh, R. v. 634.11:576.354.4
Zur Frage nach dem wissenschaftlichen Nachweis einer cytologisch bedingten Ei- und Zygotensterilität bei triploiden Apfelsorten. **(The scientific demonstration of a cytologically conditioned egg cell and zygote sterility in triploid apple varieties.)**
Züchter 1934 : **6** : 86–88.
A criticism of inaccuracies on the part of Steinegger with regard to the heterotypic division

in *Malus*. Micro-photographs are given to shew that this is accompanied by cell wall formation in the variety Boskoop Belle. Since this wall is not apparent in Steinegger's figures the author concludes that his preparations were not of such a quality as to justify his conclusions with regard to the cytological nature of the sterility.

1081. Veh, R. v. 634.11:581.162.52
Beiträge zur Frage nach den Befruchtungsverhältnissen der für Deutschland wertvollsten Kern–, Stein– und Beerenobstsorten. II. Entwicklungsgeschichtlich-cytologische Untersuchung der Samenanlagen der Apfelsorte "Schöner v. Boskoop." (**On the problem of the conditions of fertilization in the varieties of pome fruits, stone fruits and berries, regarded as most useful in Germany. II. Ontogenetic-cytological investigations of the ovules of the "Boskoop Belle" apple.**)
Gartenbauwissenschaft 1933: **8**: 146–214.

A more elaborate exposition of the observations, results and views and arguments contained in the discussion on fertilization in various forms of fruit, previously reviewed (see "Plant Breeding Abstracts," Vol. III, Abst. 722, Vol. IV, Absts. 464, 750). An extensive bibliography provides a key to the work of the other investigators on the subject.

1082. Cartledge, J. L., Shamel, A. D. and 634.13:575.25:576.356.5
Blakeslee, A. F. 576.356.5:581.331.2
Two large-fruited bud-sports of Bartlett pear identified as tetraploids by pollen size.
Science 1934: **79**: p. 373. (Abst.)

These Bartlett pear bud sports were characterized by broader leaves and larger flowers and fruits than normal for this variety. The increased size is attributed to tetraploidy. It is claimed that, as in the case of the tetraploid sports of *Datura*, it is possible to detect a tetraploid mutation by external observation of the size of the pollen without cytological examination. In the Bartlett pear the volume of the pollen grains was twice that of normal pollen. Cytological confirmation is to follow.

1083. 634.2:576.16
Kovalev, N. V. 634.2–1.524.4
(**How to utilize the wild relatives of stone fruit for breeding purposes.**)
Bull. Appl. Bot. Leningrad 1933: Ser. A (8): 129–46.

The mountains of Central Asia and the Caucasus represent the original home of the main European fruit trees and so contain the richest source in the world of new varieties, forms and characters. In the case of the stone fruits very little use has been made of these wild resources and the interrelationships of the species and the genetics of their characters are still all too little understood. *Prunus domestica*, whose origin from hybridization between *P. cerasifera* and *P. spinosa* is more or less established, has been found wild in small numbers in Central Asia. Of all the species of *Prunus*, *P. cerasifera* displays the greatest diversity, in form of fruit and stone, in flavour and in ecological as well as other morphological characters. The maximum diversity occurs in Central Asia, diminishing towards the West. They are of excellent flavour and resistant to disease and grow admirably in northern regions and many forms are being introduced direct into cultivation. In nature it hybridizes with other species, by which means many new species have originated.

M. Popov regards *P. silvestris* as having arisen from *P. cerasifera* x *Amygdalus ulmifolia*. By inter-crossing the two botanical varieties *P. cerasifera* var. *turkomarica* and *P. cerasifera* var. *orientalis*, the former from the Caucasus and the latter from Central Asia, a quantity of new and valuable forms should arise.

P. spinosa is also a polymorphic species, containing frost-resistant, drought-resistant, moisture-resistant and other interesting varieties. Many valuable hybrids of this with other species are known.

P. salicina from China is a promising parent on account of its resistance to frost and various diseases, and *P. Bosseyi* for its dwarf habit and extreme cold resistance. Various other promising combinations of species are mentioned and it is suggested that combinations of more than two species might have still further possibilities.
The apricot is found in similar abundance. The wild *Armeniaca vulgaris* is characterized by extreme resistance to both drought and frost and some of the forms have fruit of excellent quality and aroma. They are undoubtedly of value for hybridization. Extreme frost resistance is found in the dwarf *A. sibirica*, which will tolerate up to –40°C, and in *A. mandshurica*.
Various natural and artificial hybrids of these species *inter se* and with *P. cerasifera* and other species of *Prunus* are mentioned, illustrating the great possibilities of producing new types, including more frost resistant forms of *Prunus*, by means of systematic hybridization.
Wild species of cherries are also common. Various hybrids obtained by Michurin by crossing common cultivated varieties with wild species are referred to ; some of these were obtained in the first, others in the second or back-cross generations. *Cerasus microcarpa* and *C. prostrata* are mentioned as favourable parents for drought resistance and *C. fruticosa* as one of the species successfully used by Michurin, who also produced useful hybrids having up to 8 fruits per peduncle from crosses of *Prunus padus* with various common cherries.
Of the wild almonds, *Amygdalus Fenzliana* and *A. bucharica* are of interest for producing varieties resistant to frost and diseases.

Many of these species of *Prunus*, *Armeniaca* and *Amygdalus* should be of value also in improving the peach, which is not found wild in the U.S.S.R.
By the use of these wild species it ought to be possible to extend the cultivation of most of these fruits into colder and drier areas, to increase the range of types, especially in respect of transportability and flavour and to create types suitable for mechanized harvesting. The production of new constant fertile hybrids is not beyond the range of possibility.

1084. Tukey, H. B. 634.2:581.3:575
Anomalous embryos of cultivated varieties of *Prunus* with particular reference to fruit breeding.
Bot. Gaz. 1934 : **95** : 493–97.
The occurrence, frequency and character of abnormal embryos was observed in 27 varieties of peaches and 17 varieties of sweet cherry. The anomalies of development included supernumerary cotyledons, suppression of cotyledons, and peculiar shapes.
The data serve to emphasize the heterogyous condition in cultivated peaches and cherries in contrast to the more homozygous condition among the wild types. It is suggested that plant breeders should perhaps begin their study of segregation by an examination of the seed and embryos from crosses.

1085. Kobel, F. 634.23(49.4)
Die Förderung des schweizerischen Kirschenbaus durch Sortenkenntnis und Sortenwahl. (**The promotion of Swiss cherry cultivation by study and selection of varieties.**)
Schweiz. landw. Mhft. 1934 : **12** : 133–41.
As a preliminary to the improvement of the Swiss cherries a scheme is outlined by which descriptions of all the varieties now grown are to be made.

1086. Schanderl, H. 634.23:581.162.5
Über eine selbststerile Spielart der Schattenmorelle. (**On a self sterile sub-variety of the Morello cherry.**)
Gartenbauwissenschaft 1933 : **8** : 135–45.
Observations and tests have shewn that the long-budded large, Morello cherry is not completely sterile but only self sterile and gives a good set with the following pollinators : the sour cherry, Ostheimer Weichsel, and the sweet cherries, Dönissens gelbe Knorpelkirsche, Schwarze Tartarische, Maibigarrean and Kassins Frühe. A practical method of ensuring

pollination by supplying an adequate number of bees at blooming time and fixing in each Morello tree a flowering branch of one of the above mentioned pollinators is described.
Much of the paper is devoted to a refutation of Trenkle's and also Brandscheid's views on Schanderl's investigations on fertilization in pome and stone fruits.

1087. Blake, M. A. 634.25–2.111–1.521.6:575
Hardiness of 14 varieties of peaches for two years.
N. J. Hort. Soc. News 1934 : **15** : 558, 564.
Some observations on winterhardiness in a number of peach varieties in the seasons of 1933 and 1934. Elberta, Hiley, Salberta and J. H. Hale shewed bad records for both years, while Oriole proved hardy in the open winter of 1932-33 and also the consistently cool winter of 1933-34. Chili and Greensboro are regarded as the hardiest among the established commercial varieties, while of the new types developed at New Jersey Experiment Station, Oriole and Rosebud are among the most hardy with respect to continuously low temperatures. During open winters, Buttercup, Marigold, Massassoit and Oriole have been exceptionally hardy.

1088. Shoemaker, J. S. 634.25–2.111–1.521.6:575
A note on the hardiness of buds of peach varieties.
Bi-m. Bull. Ohio Agric. Expt. Sta. 1934 : **19** : 18–21.
The resistance of a considerable number of varieties of peaches to low winter temperature was studied during the season of 1933. The classification according to the hardiness of the buds was regarded as practically the same as that obtained when the varieties are grouped according to yield.
Nearly all Elberta buds were winterkilled and all other varieties proved hardier. Neither J. H. Hale nor Elberta transmit hardiness and even tend to reduce it when crossed with hardier varieties (see " Plant Breeding Abstracts," Vol. IV, Abst. 481). Only Radiance, South Haven and Veteran produced a higher percentage of the largest fruits than Carman did ; and the last named variety exceeded all others in bushels per tree.

1089. 634.3:575(47)
Moorry, N. M. 634.3–2.111–1.521.6:575
(Citrus-trees selection problems.)
Soviet Subtropics 1932 : 4th year ed. No. 3 (13) : 81–88.
The first essential for success is a thorough study of the forms already growing, to select the material of greatest cold-resistance and highest quality for planting new areas. The material at present cultivated is of varied character and origin and so represents suitable initial material for breeding. The Unshiu mandarin (Satsuma) has been a success because of its frost resistance and it is thought probable that the search for resistant forms in other citrus species may not be unsuccessful.
Certain Turkish oranges and lemons from Adjaristan shew promise of being resistant. Introductions from neighbouring countries of South West Asia, and direct from Japan and China, as well as the new citrus hybrids from America, are also regarded as promising sources of the desired material.
The role of mutation in the origin of new citrus forms and even species makes it profitable to make a search both for bud mutants and for recessive mutants which can only be disclosed by inbreeding. The artificial production of mutants should also be attempted.
For purposes both of direct introduction and of hybridization for cold resistance, especially where the lemon is concerned, of which no successful interspecific hybrids have so far been reported, the introduction of the following species is recommended : *Citrus junos* (Sieb) Tanaka, *C. ichangensis* Swingle, *Microcitrus indora* Swingle, *M. Garrowayi* and *M. virgata*. The characteristics of these species are briefly indicated ; some of them are also possessed of drought resistance. The prevalence of apogamy and multiple embryos, together with the complex genetic nature of the material and other considerations, make it necessary to carry out hybridization work on a very extensive scale.
Various other problems of citrus breeding are enumerated, among which the extension of the fruiting season, the production of suitable rootstocks and disease resistant forms, and the study of the requirements of different forms with regard to cross-pollination stand foremost.

1090. Toxopeus, H. J. 634.3:575.252(92.2)
Some cases of bud variation in citrus observed in Java.
Genetica 1933 : **15** : 241–52.

A series of bud variations is described and their possible origin as a result of either chimaera formation, chromosome aberration, factor or block mutation or somatic segregation are discussed in turn.

From his observations the author concludes that those *Citrus* species in which bud variations occur are markedly heterozygous, and that only in heterozygotes does somatic segregation produce an effect and factor or block mutations can more often manifest themselves since most of them are recessive.

The frequency of bud variation is not regarded as so very high as generally assumed, though it is admitted that *Citrus* (and also other markedly heterozygous perennials such as pear, apple, etc.) do shew many bud variations.

A list of chromosome numbers in the *Rutaceae* is included, 9 being the predominating number for *Citrus* species.

1091. Luss, A. I. 634.322
(**The varieties and bud variations in the Unshiu mandarin.**)
Bull. Appl. Bot. Leningrad 1933 : Ser. A (8) : 43–68.

A brief résumé is given of the work of Tanaka (see " Plant Breeding Abstracts," Vol. III, Abst. 267) on the varieties of the so-called Satsuma orange or *Citrus Unshiu* and their origin by bud variation. The phenomena are compared to the vegetative mutation of the potato described by Asseyeva (see " Plant Breeding Abstracts," Vol. III, Abst. 88) and a similar origin from periclinal chimaeras, as opposed to the gene mutations postulated by Tanaka, is suggested.

The plantations round the Black Sea were originally planted with material from Japan, at different times and from different sources. A study of their variability has already been made by Ekimov and Korotkova, who concluded that three varieties exist, characterized by large, small and narrow leaves respectively, but differing also in a number of other characters of the tree and fruit. The present author points out the insufficient grounds for this conclusion and his evidence makes it more probable that the three types are environmentally rather than genetically conditioned. The characteristics of the Black Sea Satsumas, which are enumerated, all correspond most closely to Tanaka's variety Owari. Variants, one with variegated leaves and fruits, another with curled leaves and large, round, thin-skinned fruits, and a third with large spines and rounded medium-sized fruits, have also been found. The presence of other variants is suspected but at present there is no direct proof.

For the supply of grafting material of superior quality, in so far as is possible, for immediate use, the trees giving the best performance are chosen on the score of observations on yield and general condition over 2–4 years. Various methods of carrying out these observations most effectively, including those proposed by Shamel, Hodson and Sax and Goven, are described and discussed. The need for more fundamental and detailed studies, and above all for co-operation between the research stations and the practical agriculturists is emphasized. Studies of the amount of variation in the material and of the possible occurrence of bud variants, and the introduction of further varieties of *C. Unshiu* from Japan are the most immediate problems.

1092. 634.5:581.163.32
Slate, G. L. 634.5–2–1.521.6
Nuts for the amateur.
Horticulture, 1934 : **12** : 80, 82.

The Northern Nut Growers' Association is doing much to stimulate interest in nuts by acting as a clearing house for information on nut culture, by discovering new and better varieties and helping growers to obtain new and better varieties.

It is recommended that more than one variety of each class of nuts should be planted to ensure cross pollination unless wild trees of the same species are nearby. Black walnuts, English

walnuts, butternuts and Japanese walnuts will pollinate each other to some extent.
A number of varieties of the various nut trees are enumerated.
The Chinese chestnut *Castanea mollissima* is partly resistant to blight. No resistant varieties of the American chestnut are known.

1093. Wood, M. N. 634.511:581.162.3
Pollination and blooming habits of the Persian walnut in California.
Tech. Bull. U.S. Dept. Agric. 1934: No. 387: Pp. 56.
On account of the discrepancies in the accounts of the fertility of the Persian (English) Walnut, *Juglans regia*, a detailed study was made of pollination and related problems.
The course of anthesis is described and experiments on self-fertility shewed that all the varieties tested were both self and inter-fertile and that the yield, though variation occurred, was satisfactory from a commercial point of view.
No advantage in the matter of yield seems to be gained by cross-pollination.
A study was therefore made on dichogamy and it was found that a number of factors such as age, climate, season and weather very materially affected this condition.
Charts are given of the average period of bloom of varieties and species in various localities in California which should prove of value to growers in their selection of varieties to ensure proper set of fruit.
Other factors examined affecting the set of nuts were, viability of pollen, amount of pollen produced, efficiency of distribution, length of period of pollen production, number of pistils produced, size of pistil when receiving pollen and length of period of pistil receptivity.
Cases of parthenogenesis were observed. Finally because of the existing confusion with regard to the naming of varieties some brief notes are given on those used in the experiments.

1094. Sun, Von-Gee 634.58:575.2
(Variation and correlation characters of the "Dragon" pea-nut.)
Tech. Bull. Agric. Expt. Sta. Chekiang Univ. 1932: No. 15.
In a study of variation in 131 plants of the "Dragon" pea-nut the following characteristics were investigated: yield of dry pods per plant and of dry seeds per plant; number of seeds per plant and percentage of seeds in terms of pods per plant. Definite correlations were found between: yield of pods and yield of seeds ($r = 0{\cdot}965 \pm 0{\cdot}00405$); yield of pod and number of seeds ($r = 0{\cdot}967 \pm 0{\cdot}00380$); weight of seeds and number of seeds ($r = 0{\cdot}948 \pm 0{\cdot}00597$); number of seeds and percentage of seeds in terms of pods ($r = -{\cdot}396 \pm 0{\cdot}0496$).

1095. McClintock, J. A. 634.711 Van Fleet
The Van Fleet raspberry.
Circ. Tenn. Agric. Expt. Sta. 1930: No. 29: Pp. 4.
The Van Fleet raspberry originated in 1911 as a seedling of *Rubus innominatus* from China crossed with the Cuthbert red raspberry. It is particularly vigorous, remarkably resistant to various leaf and cane diseases and withstands dry, hot weather. Though it bloomed late in tests in 1926 and 1927, this proved advantageous in enabling the canes to escape severe frost late in April and prolonging the raspberry season.
Though the fruit has undesirable characteristics in size, shape, colour and texture, it is of sufficiently good quality to make the variety of value for home use. The chemical composition of the fruit makes the Van Fleet specially suitable for jelly making.

1096. 634.711.3 Newburgh
634.711.3 Lloyd George
634.711.2 Naples
Worth-while raspberry varieties.
Horticulture 1934: **12**: p. 82.
Brief notes on new varieties, *viz.*, the two red raspberries, the Newburgh, Lloyd George and the black cap raspberry, Naples.

1097. Bailey, L. H. 634.715(7)
Certain northern blackberries.
Gentes Herbarum 1934 : **3** : Fasc. V : 247–71.
A systematic study of a number of doubtful groups in the northern blackberries in various states in U.S.A. The difficulties that have arisen from the large number of supposed natural hybrids that have hitherto been assumed to exist is pointed out and the necessity for concentrating in future on the identification of species and then classifying and formulating keys for the units is emphasized.

1098. East, E. M. 634.75:575.127.2:576.356.7
A novel type of hybridity in *Fragaria*.
Genetics 1934 : **19** : 167–74.
A cross has been previously described in which from pollination of *F. vesca* (n = 7) by *F. virginiana* (n = 28) a plant with 14 chromosomes was obtained differing from *F. vesca* in a certain number of characters which are enumerated. The other plants produced had 35 chromosomes. The diploid plant contained 51–63 per cent good pollen but the anthers mostly failed to dehisce. Good fruits could be obtained therefore only by artificial pollination. The plant displayed marked heterosis.
The selfed seeds were low in germinating power, giving 15 and 11 per cent germination respectively in two tests. In the resulting plants (F_2), those which flowered normally varied from 39 to 79 per cent in pollen fertility and the dehiscence was still below normal. Three of the plants failed to flower in three successive seasons and eight further plants flowered but were entirely sterile, having 5–30 per cent good pollen and no dehiscence.
The plants varied in a great many characters, exceeding the limits of variation in the ordinary diploid *Fragarias* : some were dwarf, others long and straggling ; they also segregated for colour, stamen length and characters of the leaf and runners. A new character in the form of sessile stamens appeared in five plants. Two of the sterile plants had 21 chromosomes, the rest had 14, but even these latter exhibited certain meiotic irregularities. All plants were hermaphrodite.
All these points, and especially the variability of the F_2, confirm the interpretation previously suggested, that the diploid hybrid arose by the fertilization of the seven chromosomes of *F. vesca* by one genom of *F. virginiana*, the remaining 21 chromosomes of the latter being lost in the cytoplasm. In true hybrids of these two species, having 35 chromosomes, the formation of seven pairs and the extrusion of the remaining 21 at meiosis has been observed.

1099. Husfeld, B. and Scherz, W. 634.835:575.11
Rebenzüchtung. **(Vine breeding.)**
Naturwissenschaften 1934 : **22** : 285–88.
Erwin Baur first shewed that the desired combination of resistance and quality from crosses between American and European vines could not be expected before the F_2 and that to ensure success the work must be carried out on a very large scale.
The main aims of the Kaiser Wilhelm Institute in Müncheberg have been the breeding of disease resistant vines and scions, the creation of useful stocks and the production of the " ideal vine." As the F_1 hybrids between German species of *Vitis vinifera* and American wild vines have not been vegetatively propagated to a large enough extent they were grafted on the F_1 hybrids between French and American vines, which were used as stocks or direct producers. In this way a large quantity of seed was obtained to provide the necessary initial material for the three objects in view. A most suitable cross was Riparia x Gamay 595 Oberlin, a hermaphrodite self-fertile vine.
The seedlings are being tested for resistance to *Plasmopara*, *Oidium* and *Pseudopeziza*. The use of self-fertilized seed from hermaphrodite flowers is encouraged as these yield an immense number of forms which may shew new combinations. The possible value of indigenous varieties in crosses with American vines is being investigated.
The vines are grown under unfavourable environment so that the high yielding sorts selected will withstand variation in climatic and other conditions.

1100. PAULSEN, F. and BERNA, R. 634.835:581.162.5
Seconda nota sull'uva " Ciminnita." Risultati delle esperienze di fecondazione artificiale. (**Second note on the grape "Ciminnita." The results of experiments with artificial pollination.**)
Ital. Agric. 1934 : **71** : 117–19.
The chief defect of this otherwise excellent variety is its marked tendency to coulure and abortion.
Artificial pollination by various methods and girdling increased the set of fruit, especially when the pollen was spread on by means of a small brush.
The stock also definitely influenced the degree of fruit setting.

1101. RAVAT, J. F. 634.835.09
Les hybrides de la vigne. (**Vine hybrids.**)
Rev. Vitic. Paris 1934 : **80** : 236–39.
The value and importance of hybrids in improving the quality of the wine and for resistance to disease is emphasized.

1102. MOOG, H. 634.872.09
Beiträge zur Ampelographie. (IV. Mitteilung). (**Contributions on ampelography. IV.**)
Gartenbauwissenschaft 1933 : **8** : 215–38.
In continuation of this series of investigations (see " Plant Breeding Abstracts," Vol. IV, Abst. 784), European varieties (*Vitis vinifera* L.) and their hybrids are here described. Since many of the hybrids are being used in breeding work, their morphological characteristics should be of interest.

1103. 634.872.09 Edda Mussolini
L' " Edda Mussolini "—una nuova varietà di uva da tavola. (**The Edda Mussolini—a new variety of dessert grape.**)
Nuova Vita Rur. 1934 : **6** : p. 83.
This variety has been obtained from Zibibbo artificially pollinated by electromagnetically treated pollen from Castel 1028 and combines the good qualities of both these parent types.

1104. BAILEY, L. H. 634.84(7)
The species of grapes peculiar to North America.
Gentes Herbarum 1934 : **3** : Fasc. IV : 151–244.
This paper which is an attempt to complete the work begun 50 years ago on botanical and horticultural identities of North American grapes deals in Part I with (1) an historical survey of the literature on systematic studies of North American *Vitis*, (2) difficulties of definition and identification, (3) the problems of hybridity, (4) the morphology of the flower and other parts of the vine.
The second part of the paper contains detailed discussions of the individual species and ends with a list of free binomials.

1105. 634.848.1.09
NEGRUL, A. M. 634.836.7:575(47)
(**How to utilize *Vitis rotundifolia* for grape breeding purposes in U.S.S.R.**)
Bull. Appl. Bot. Leningrad 1933 : Ser. A (8) : 69–84.
The production of forms resistant to phylloxera and mildew (*Plasmopara viticola*) is the major problem of vine breeding in the U.S.S.R.
At Odessa there are 15,000 hybrid seedlings now growing. This is at the Ukrainian Institute of Viticulture and it shews that the scale of work is far behind that in other countries and must be extended.
The two species of the subgenus *Muscadinia*, *Vitis rotundifolia* and *V. Munsoniana*, are briefly described, with indications of the regions of their natural distribution and the ecological con-

ditions of these regions ; these are mainly moist and warm and very liable to all sorts of vine diseases. The vines of the *Muscadinia* group are immune to these diseases, including phylloxera. The results of cytological investigations and of hybridization work in the U.S.A. are reviewed. Special interest is attached to the presence of an extra chromosome pair over and above the common 19 of *Euvitis*, making a diploid number 40, to the production of hermaphrodites by crossing two dioecious forms, and to the successful crossing of *Euvitis* with *Muscadinia* ; also to the suggestion of Husfeld (see " Plant Breeding Abstracts," Vol. III, Abst. 276) that it might be possible to produce fertile hybrids by using the aberrant form of *V. vinifera* with 40 chromosomes. The author expresses confidence that valuable hybrids of *V. vinifera* and *V. rotundifolia* will be eventually produced.
V. rotundifolia grows and thrives in the Soviet subtropics, where conditions are similar to those in its natural home in America ; it withstands the frosts which occur there and reacts well to the length of day. Some of the new forms should be capable of direct introduction into these regions, where the prevalence of disease makes the cultivation of the common vine impossible, and in the light of the above remarks it is strongly recommended that *V. rotundifolia* should be used in breeding in the Soviet Union.

FORESTRY 634.9

1106. 634.972:575(48.9)
634.972:575.127.2
LARSEN, C. S. 634.972:581.162.3
Forest tree breeding.
Yearb. R. Vet. Agric. Coll., Copenhagen 1934 : 93–113.
A paper presenting valuable constructive observations on breeding and selection and based on forestry investigations in different countries and on the author's own work. A series of successful and valuable crosses such as Japanese x European larch, various *Pinus* hybrids and *Picea* hybrids are mentioned.
The importance of variation as a factor affecting selection in tree plantations is pointed out and the necessity of ascertaining the possibly latent parental characteristics by working with single individuals and artificial selfing and crossing is emphasized.
One way of obtaining the best seed for forest improvement is to select either the best possible plantations or the best individuals from the handsomest and most uniform plantations and to observe the performance of progeny—a process which may require from 5–20 years.
Another method which consists in breeding, though involving expense, would be worth both the time and labour required. Various methods of artificial pollination used with success in America, in Germany and in Denmark by the author are described in detail and illustrated by photographs and drawings and the results are discussed.
For trees such as the beech and oak which do not set seed for many years the role of vegetative propagation in reafforestation by utilizing possible valuable hybrids (and above all the handsomest and most valuable trees in the country) in forest improvement is clear ; and here the author urges the establishment of an arboretum in which specimens of the best types of indigenous trees could be kept and grafts and cuttings planted in isolated places and thus protected against foreign pollen, giving material for hybridization. Mixed plantations of graftings of two parent types known to have produced a good cross could also be laid down for seed production. By vegetative propagation also the flowering conditions of different species and individuals could be studied.
Attention is drawn to the advantages of exchanging material with foreign countries and of various methods of hastening flowering.

1107. SAX, K. 634.972.6:576.312.35
Chromosome numbers in *Ulmus* and related genera.
J. Arnold Arb. 1933 : **14** : 82–84.
Most species examined had 14 pairs of chromosomes, but *U. americana* and *U. pendula* are tetraploids with 28, with indications of secondary pairing.
Regular meiosis was observed in the various forms of *U. hollandica*, which are thought to be hybrids of *U. glabra* and *U. foliacea*.

Crosses were made between *U. americana* (n = 28) and *U. laevis* (n = 14) and the seedlings are to be examined.
Similarly 14 chromosome pairs were observed in *Zelkova*; in *Celtis* and in *Hemiptelea* however the chromosomes were irregular and evidently polyploid, a high percentage of the pollen also being sterile.
All genera examined had a basic number 14.

1108. KLIKA, J. 634.975:576.16(43.7)
Poznámky k rasám (ekotypům) borovice v Československu. (**The occurrence of the races of pines in the Czecho Slovakian Republic.**)
Věst. (Bull.) Československ. Akad. Zeměd. 1934: **10**: 186–89.
Includes a description of a new race of pine, *Pinus silvestris* f. *carpatica* m. which is resistant to breaking injury from falls of snow.

1109. MATSUMOTO, K. 634.975:576.312.35
(**On the chromosome number of *Cryptomeria japonica* D. Don. and *Taiwania cryptomerioides* Hayata.**)
Contr. Lab. Genet. Kyoto Imp. Univ. No. 40: 39–44.
In these two nearly related conifers *Cryptomeria japonica* D. Don and *Taiwania cryptomerioides* Hayata 22 chromosomes were found in the root tips and 11 was the gametic number in the pollen mother cells of *Cryptomeria japonica*. Some particulars of the mode of constriction in the somatic metaphase plate and other accompanying phenomena of cell division are recorded.

VEGETABLES 635

1110. LAMPRECHT, H. 635.1/7:575
Förädlingsarbetet med köksväxter å Weibullsholm. (**Breeding work with culinary plants at Weibullsholm.**)
Weibulls Årsbok 1934: **29**: 27–29.
A very brief account of the methods used in breeding culinary plants.

1111. DANIEL, L. 635.34:575.257:635.262
Sur la descendance de l'Alliaire greffée sur le chou. (**On the progeny of hedge garlic grafted on cabbage.**)
C.R. Acad. Sci. Paris 1933: **196**: 1701–10.
The grafts were morphologically distinct, possessed leaves of larger size and of reduced odour, such that carrier pigeons ate them with relish, whilst refusing the leaves of the control garlic altogether.
Seeds from the grafts shewing the most marked divergence from the normal were sown and their progeny displayed a number of morphological abnormalities and differed in cold resistance. From these observations the author is led to conclude that the variations observed in orchards of fruit trees are induced in a similar manner.

1112. 635.61:575.061.63
SINNOTT, E. W. and HOUGHTALING, H. 635.61:575–181
Pattern inheritance in *Cucurbita*.
Amer. Nat. 1934: **68**: 167–68.
Cucurbita types of similar index (*i.e.*, the ratio of the polar to the equatorial diameter) may differ in actual shape or pattern. There are two nearly isodiametric pure lines in one of which the longitudinal section of the fruit is ovate and in the other of which the outline is obovate. Each type differs by a single gene (a and b respectively) from lines with a flattened (disc) fruit shape, AB. In F_2 crosses between each of these "sphere" lines and disc, the segregating "spheres" resemble their parental "spheres" in index and in specific pattern. F_2 crosses between these two "spheres," however, produced 9 discs : 6 "spheres" : 1 elongate; but

among the " spheres " (all similar in index) the two definite patterns ovate and obovate occur in approximately equal numbers. Hence each of these genes affects not only a ratio between two dimensions but an entire pattern, involving much more complex growth relationships. The actual pattern depends not only on a specific gene but also upon the whole genetic complex of which this gene forms part.

1113. BOSWELL, V. R. ET AL. 635.64(73)
Descriptions of types of principal American varieties of tomatoes.
Misc. Pub. U.S. Dept. Agric. 1933: No. 160: Pp. 23.

These tomato descriptions which have been compiled by the U.S. Department of Agriculture in co-operation with the State Experiment Stations and various commercial seed concerns, farmers, canning factories and market gardeners, have been drawn up on a practical rather than a theoretical basis.

The standard for each of the 9 varieties studied was based on an actual stock.

A note on the effects of environment on the type and some useful hints on comparing tomato stocks or strains with the published standards are given.

In addition to the characterization of the individual varieties and some good photographs, information is included on their history, adaptability, season and use.

1114. AFIFY, A. 635.64:575.127.2:576.312
The cytology of the hybrid between *Lycopersicum esculentum* and L. *racemigerum* in relation to its parents.
Genetica 1933: 15: 225–40.

In *L. esculentum* and *L. racemigerum* and in their hybrid the chromosome number was 2n = 24. Meiosis was normal in both parents. Twelve bivalents were constantly formed and at anaphase separation lagging of those bivalents which had interstitial chiasmata at metaphase occurred. In the diploid hybrid secondary association of the chromosomes was observed at meiosis and at the second metaphase. In the induced tetraploid hybrid the chromosome complement was composed of varying numbers of quadrivalents and bivalents and individual quadrivalents were seen at metaphase.

The general interpretation of secondary chromosome association as indicating a lower basic number of chromosomes is shewn to be inapplicable to the present material and another explanation is tentatively suggested though admittedly the solution must await further evidence.

1115. HOWLETT, F. S. 635.64:581.13:576.354.4
Effect of carbo-hydrate deficiency upon meiosis in plants with particular reference to the tomato.
Amer. Nat. 1934: 68: 169–70.

The importance of an environmental factor in producing male sterility and the desirability of constant and known environmental conditions in certain genetic and cytological experiments was demonstrated as follows :—

Carbohydrate deficiency was induced by growing the plants in an excessive nitrogen supply, under low light conditions at a temperature of 65–70°F.

Depending on the carbohydrate deficiency the flowers ranged in size from those which failed to reach anthesis to those which apparently opened normally. Self and cross-pollination tests were made and in the flowers which reached anthesis pollen sterility varied according to the degree of carbohydrate deficiency, reaching 100 per cent in the flowers of the most carbohydrate deficient plants. This sterility varied from one part of an anther to another, from anther to anther, from flower to flower and cluster to cluster on the same plant. In general the meiotic divisions were regular in microsporogenesis, but degeneration occurred immediately after or shortly after telophase II and from one to all four cells degenerated according to the severity of the deficiency.

1116. AGERBERG, L. S., SCHMIDT, M. and SENGBUSCH, R. v. 635.64–2.484–1.521.6

Zur Entwicklungsphysiologie von *Cladosporium fulvum* und über die Widerstandsfähigkeit von *Solanum racemigerum* gegen diesen Parasiten. II. (**The developmental physiology of *Cladosporium fulvum* and the resistance of *Solanum racemigerum* to these parasites II.**)

Gartenbauwissenschaft 1933 : **8** : 346–58.

Observations recorded in the course of further studies of artificial cultures of *C. fulvum* tend in the authors' opinion to shew that Schmidt's assumption (see " Plant Breeding Abstracts," Vol. IV, Abst. 813) of the action of an inhibitory principle, " prohibitin " in explanation of resistance of *S. racemigerum* to *C. fulvum* must be provisionally regarded as not proven.

The occurrence of a saprophytic and a non-parasitic relationship between *C. fulvum* and *S. racemigerum* was demonstrated.

1117. YASUDA, S. 635.646:575.127.5:581.145.2

(The second report on the behaviour of the pollen tubes in the production of seedless fruits caused by interspecific pollination.)

Jap. J. Genet. 1934 : **9** : 118–24.

In continuation of the experiments on the effect of pollination of the egg plant by *Petunia*, previously reviewed (see " Plant Breeding Abstracts," Vol. IV, Abst. 285), additional data have now been obtained which shew that :—

(1) Parthenocarpic development of the ovaries of the egg plants had already begun before the pollen tubes of *Petunia violacea* reached the ovaries. (2) An aqueous extract of *Petunia* pollen injected into the ovary of the egg plant was often followed by parthenocarpic development of the ovary. (3) Cell division was stimulated in the tissue near the site of the injection, though whether this effect was due to the presence of the extract or to wound hormone action is unknown (4) An injection of pure water produced no stimulation and an aqueous extract of tomato pollen and pricking with a needle only rarely resulted in parthenocarpic fruits and in such cases the rapidity of growth was much less than when *Petunia* pollen extract was used.

It is concluded that the pollen tube of *Petunia* may to some extent stimulate the ovary of the egg plant by deeply penetrating the style.

These results agree with the author's findings on *Nicotiana* species.

1118. 635.651:581.145.2

MARTIN, J. N. and WATT, J. R. 635.651:581.331

Irregular sporogenesis and polyembryony in some Leguminosae.

Iowa St. Coll. J. Sci. 1934 : **8** : 303–07.

Some data on the occurrence of polyembryony and other irregularities of reproduction with some considerations on their probable relation to seed production in *Vicia americana* are included in this paper which, however, deals mainly with species of *Melilotus*, *Trifolium* and *Medicago*.

1119. PIROŽNIKOVA, M. F. 635.652(47)

[Varieties of *Phaseolus* in U.S.S.R. (According to data reported by the U.S.S.R. State varietal Testing Service.)]

Publ. Var. Test. Division U.S.S.R. Inst. Pl. Ind., Leningrad 1933 : Pp. 71.

The Department of Varietal Testing is working on the following problems : (1) to determine the best and the possible regions for cultivation, (2) to obtain the best possible collection of varieties for industry and export and (3) to find the best varieties for each different region. The present bulletin presents the results of the first 2–3 years' work. Further questions under investigation were the factors determining yield, the resistance of different varieties to various diseases and the quality of the beans.

The tests were carried out in different parts of the U.S.S.R. and the results are described separately. The dates of flowering and maturity, the yields and the weight of 1,000 beans are recorded. These observations make it possible to draw valuable conclusions as to the moisture and other requirements of the different varieties and at different periods of their growth

and as to the lines along which breeding work must be directed. The first requirements are to breed varieties ripening earlier and resistant to spring frosts—for northern regions ; resistant to drought and suitable for mechanized farming—for arid regions ; resistant to fungous disease—for moist regions ; and with small white beans and thin skin—for export.

1120. 635.652:575.11:581.48
LAMPRECHT, H. 635.652:575.11.061.1:581.48
Zur Genetik von *Phaseolus vulgaris* VII. Zwei weitere Gene für Sameneigenschaften, *Cor* und *Fast*. (**On the genetics of *Phaseolus vulgaris* VII. Two more genes for seed characters, *Cor* and *Fast*.**)
Hereditas 1934 : **19** : 163–76.

An analysis was made of the genetics of the corona, a ring-shaped marking round the hilum. A number of crosses were made and the F_2 shewed a clear monohybrid segregation into *Cor Cor* without a corona, *cor cor* with a deep corona and *Cor cor* intermediate like the F_1.
The second character investigated determined the shape of the seed. An obliquely pointed type named *fastigiata* was observed which when crossed with *truncatum* types behaved as a simple recessive. The analysis was best made in the F_3.

1121. SCHREIBER, F. 635.652:575.11.061.6
Zur Genetik der weissen Samenfarbe bei *Phaseolus vulgaris*. (**On the genetics of white seed colour in *Phaseolus vulgaris*.**)
Züchter 1934 : **6** : 53–61.

Typical crosses exemplifying the effects of the presence or absence of the basic colour factor P in producing two white types, *viz.*, " albinos " carrying colour genes but unpigmented (ppXX) and " true whites " containing pigment but colourless (PPxx) are described (see " Plant Breeding Abstracts," Vol. II, Abst. 522, Vol. III, Absts. 128 and 129). Another cross also shewed that the factor P alone is incapable of producing colour (*i.e.*, other than white) in the absence of other accessory colour genes.
A third white seeded type owes its lack of pigmentation to a dominant factor L inhibiting the partial spotting and capable of expression only when the genetic factor for self-colour is absent (designated by Shaw and Norton 1918 as T). This third type is recessive to self-colour but dominant to spotting.
The spotted form Beste von Allen crossed by the white fruited variety Konservanda revealed two genetically different types of white, one recessive and the other dominant to " spotted." The underlying genotypes were in Beste von Allen, PPttll, and in the albinotic Konservanda, ppTTLL.
The colour constitution of twenty seven white varieties was tested by crossing with Riesen-Konserven, the inhibited spotted type PPttLL, and the results obtained are discussed and tabulated.

1122. LAMPRECHT, H. 635.652:575.11.061.6:581.48
Zur Genetik von *Phaseolus vulgaris* VIII. Über Farbenverteilung und Vererbung der Teilfarbkeit der Testa. (**On the genetics of *Phaseolus vulgaris* VIII. On colour distribution and the inheritance of partial coloration of the testa.**)
Hereditas 1934 : **19** : 177–222.

The various colour patterns of the testa characteristic of *Ph. vulgaris* can be grouped into two main types, (1) patterned all over and (2) partially patterned. Both groups can be subdivided into uniformly and multi-coloured types of which the latter are further divided into mottled, striped and speckled. Among the partially patterned groups the author distinguishes at least 20 types of which a number are described.
The paper contains a critical review of the work already published on the inheritance of colour distribution (see " Plant Breeding Abstracts," Vol. III, Abst. 753) and then proceeds to a genetical analysis of the various partially coloured types which are determined by at least four or probably five different pairs of genes.

It is clear that the different genes determine different patterns of the seed coat and the various types are due to combinations of these genes, which all shew independent inheritance.
As an explanation of the occurrence of a number of white seeded plants where none or only a few were expected, the author suggests that a certain combination of genes or a special inhibitor has prevented the expression of colour.

1123. CUTLER, G. H. 635.655:575.12:578.08
A simple method for making soybean hybrids.
J. Amer. Soc. Agron. 1934 : **26** : 252–54.
A bulk method of crossing soya bean plants of various varieties is exemplified. The percentage of natural crossing actually found in the experiment varied from 0·38 to 2·43 and assuming the occurrence of the reciprocal cross to be equally likely the percentage of new hybrids due to natural crossing should be from 0·76 to nearly 5.
The method is recommended for trial where the object in view is the production of hybrids, but not for use in genetic studies since the identity of the pollen parent is lost.

1124. BIAN, KOU-YUEN 635.655:575.2
(A study on the correlation characters of soybean.)
Tech. Bull. Agric. Expt. Sta. Chekiang Univ. 1930 : No. 7.
Between 273 and 291 plants taken from four varieties of soya beans were examined and the following correlations found :—

Yield of seeds in grammes and	number of pods	r = ·783 ± ·015
,, ,, ,, ,, ,,	thickness of stem	r = ·702 ± .020
,, ,, ,, ,, ,,	height of plant	r = ·543 ± ·028
,, ,, ,, ,, ,,	number of 3 seeded pods	r = ·382 ± ·034

1125. KLOKOV, M. V. and DESIATOVA-SCHOSTENKO, N. A. 635.71(47)
(Critical revue of the genus *Thymus* in the S.E. European section of the U.S.S.R. and W. Turkestan.)
Bull. Jard. Bot. Acad. Sci. L'URSS 1932 : **30** : 523–50.
Description of 11 species of *Thymus* of which 5 are new, with indications of their geographical distribution.

1126. YAKOVLEVA, S. V. 635.71:576.312.35
(Karyological investigation of some *Salvia* species.)
Bull. Appl. Bot. Leningrad 1933 : Ser. 2 (5) : 207–13.
A study has been made of the chromosome numbers of those species of most value in point of essentail oil content and others which may be of interest for interspecific crossing. The results of the root-tip counts are tabulated and compared with the diploid and haploid numbers given by Scheel. The agreement is good, though different numbers were found for some species.

1127. GUN'KO, G. K. 677.051.41:589.77
(Teasel.)
Lenin Acad. Agric. Sci., Inst. Pl. Ind. Leningrad 1932 : No. 42 : Pp. 122.
Following upon the history of the use of the plant for textile purposes, botanical descriptions of the species *Dipsacus sativus* are given, together with general questions of the cultivation and utilization of the plant.
The French teasels are found to be the best in quality, the Crimean ones, though good, being inferior to the French in the density and uniformity of distribution of the bristles. This defect, it is thought, could easily be overcome by breeding.

TRELOAR, A. E. 519

Outlines of biometric analysis. Part I.

Burgess Publishing Co., Minn. U.S.A., 1933: Pp. 65. (Not priced).

This is a mimeograph production by the assistant Professor of Biometry, University of Minnesota, who worked in close association for several years with J. Arthur Harris, well known for his contributions to biometric theory. Its aim is to aid students to grasp the fundamentals of a course in "Biometric Principles" given by the author. A second part is promised to deal with the topic of "Small Sample" analysis. The present work consists of twelve chapters, which follow very much the order of treatment to be expected in an introductory course on statistics. The author deals with biological variation, the calculation of mean values and measures of dispersion, with the normal probability curve, and in particular with the binomial series. Tests of goodness of fit are discussed. Problems in more than one variable include the calculation of regression and correlation coefficients, and there is a useful chapter on the errors of random sampling.

The book is written in a very careful and interesting way, and although no attempt is made to prove any but the most elementary of the mathematical formulae, a good understanding is given of the *rationale* of the various methods, and of the underlying assumptions. A foretaste is given from time to time of what we may expect from the second part, when exact tests for small samples will be deduced. The author has read widely, and has a sound knowledge of his subject, and the book can be recommended confidently to all who are in the habit of applying statistical methods in their observational work. J. W.

SNEDECOR, G. W. 519

Calculation and interpretation of analysis of variance and co-variance.

Collegiate Press, Inc., Ames, Iowa, 1934: $1. Pp. 96.

The application of statistical methods in the domain of field experimentation and the use of the technique of analysis of variance introduced by R. A. Fisher are now widespread. In particular American agronomists have taken up these methods with eagerness, and the present manual, written by an author of experience who formerly produced a very useful handbook on "Correlation and Machine Calculation," is an attempt to put before the American public a short but exhaustive study of the methods. As befits an agricultural college, the examples are all chosen from agronomic sources. An interesting and well written account, from the non-mathematical standpoint, is given of the various processes, in increasing order of complexity, and each fresh point, as it is discussed, is illustrated from the practical data of experimentation of one kind or another. The last section of the book is taken up with the study of the analysis of covariance technique. This is less familiar, since it was only introduced recently by Fisher to the fourth edition of his book "Statistical methods for research workers." The purpose of the method is, however, clearly explained although the test of significance for the adjusted mean squares obtained by correcting for the influence of the correlated variables is not given, a point that requires closer consideration than has been given to it by the author. J. W.

ROBERTS, H. F. 575.1

Plant hybridization before Mendel.

Humphrey Milford, Oxford University Press, London, 1929: 18*s.* 0*d.* Pp. xiv + 374: 48 illus.

This valuable study deals with the contributions made to the knowledge of plant breeding in its widest aspects, from the cultivation of the date palm by the ancient Assyrians down to 1900 when Mendel's work was rediscovered and its fundamental significance recognized almost simultaneously by De Vries, Correns and von Tschermak. The main events are treated in chronological order and in considerable detail, and quotations, translated where necessary, are freely given.

To many readers for whom the science of genetics begins with Mendel it will be a surprise to discover how much and how accurate was the knowledge before the precise genetical laws were formulated and how nearly Mendel's results was anticipated by many workers.

The work of Mendel himself is very fully treated and the book concludes with the contribution made by Bateson to the discovery of Mendel's investigations.

SHARP, L. W. 576.3
Introduction to cytology.
McGraw-Hill Book Co., Inc., New York and London, 1934: 3rd ed. 30*s*.
Pp. xiv + 567; Illus.

The eight years which have elapsed since the publication of the second edition of this work have probably witnessed a more remarkable advance in cytological technique, and hence in cytological theory, than any preceding period. The second edition has therefore of necessity been radically revised and very considerably enlarged. The early chapters, dealing with the constitution of the cell and of the protoplasm, have been definitely reduced, much more emphasis being now given to chromosome structure and behaviour and less to general questions affecting the cell. In the account of chromosome structure an attempt is made to reconcile the chromonema and chromomere theories by supposing that there are certain points along the thread at which the chromatic material tends to be concentrated, though when it is abundant this fact is not apparent and it appears as if equally distributed along the thread. A rather full account is given of recent studies of the morphology of chromosomes, which are throwing more and more light on hereditary phenomena, especially those concerning the location of the genes in the chromosomes.

Claiming as it does to be an introduction to the subject, the book could not be expected to do more than merely touch upon the more intricate and obscure problems of modern cytology. This in fact is what is done: questions such as the nature and behaviour of chiasmata, of *Oenothera* and of the speltoids are all mentioned but without going into any great detail, rather as illustrations of a principle than in their controversial aspect. All the more important modern views and phenomena however receive consideration; the behaviour of chromosome sets or genoms is summarized in a series of chapters on polyploidy, heteroploidy and the behaviour of species hybrids; the phenomena of sex determination and sex linkage receive a special chapter, as do also cytoplasmic inheritance and the problems of apomixis and allied phenomena. The final chapter contains a scholarly review of the development of the science of cytology from the recognition of the cellular structure of organisms in 1665 by Robert Hooke, up to the present era of cytology which begins with Mendelism in 1900. Particular tribute is paid to Weismann as having in his speculations come particularly near to the modern cytological interpretation of heredity.

The whole work is written from the point of view of the student, to whom it will prove an admirable guide, and the provision of an exhaustive bibliography covering 83 pages, together with a very adequate index, greatly enhances its value.

LAURIE, A. and CHADWICK, L. C. 578.082:635.9
Commercial flower forcing. The fundamentals and their practical application to the culture of greenhouse crops.
P. Blakiston's Son & Co., Inc., Philadelphia 1934: $4.00: Pp. x + 519.
49 illus.

To those unversed in the care of plants in the greenhouse the present work will prove a useful guide. The essentials of modern greenhouse practice are described, including the use of artificial agencies such as control of length of day, application of fertilizers of various kinds and other special methods. Attention is given to the methods of propagation and their suitability to different types of plants, to the common ailments of different plants when grown indoors and the methods of their control. The latter part of the book is devoted to the cultural practices applicable to the various plants in turn.

The value of the work is considerably increased by the provision of full and classified bibliographies at the termination of each chapter.

BAILEY, L. H. 58(014)
How plants get their names.
The Macmillan Company, New York, 1933: 12*s*. 0*d*. Pp. vi + 209.

A book for the American layman who wishes to acquire information on some elementary principles of classification.

Following an appreciation of Linnaeus' work, the obvious necessity for accurate identification of plant material before classification is emphasized and the rules of nomenclature, and certain standpoints of the International and the American Codes are treated. A list of names of genera and species with suggestions on the pronunciation and the significance of Latin adjectives used in the botanical binomials are given.

MOLISCH, H. 581.19:576.16
Pflanzenchemie und Pflanzenverwandtschaft. (**Plant chemistry and plant relationship.**)
Gustav Fischer, Jena, 1933: Unbound RM. 5, bound RM. 6. Pp. viii + 118. 12 illus.

Systematic botany is very naturally based mainly upon the morphological resemblances and relationships of the plant groups. Of recent years however, methods which come nearer to the fundamental properties of living organisms, and so distinguish the true from the superficial resemblance, have come very much more into evidence. Of these methods the two chief are the cyto-genetic and the chemical. The work under review gives an outline of the present state of our knowledge of the second method.

In an authoritative way the author discusses the occurrence of specific chemical compounds in groups of related plants, then the different chemical substances found in plants are described separately, with indications of their distribution through the plant kingdom.

The application of serological methods in botany receives special consideration. In referring to the phenomena of self-sterility and grafting the possibility is suggested that differences of a chemical nature may exist even between individuals of a pure line, though definite proof of their existence is so far lacking.

63.0015
Stations expérimentales et autres institutions officielles ou privées s'occupant du développement et de l'amélioration de l'agriculture dans les pays chauds. (**Experimental stations and other official or private institutions engaged in the development and improvement of agriculture in tropical countries.**)
Inst. Int. Agric. Rome 1931: Pp. 166.
Les institutions d'expérimentation agricole dans les pays tempérés. (**The agricultural research institutes in temperate countries.**)
Inst. Int. Agric. Rome 1933: Pp. 306.
Bibliography of tropical agriculture 1931.
Inst. Int. Agric. Rome 1932: Pp. 70.

Issued by the International Institute of Agriculture the above two handbooks describe the organization and work of agricultural research in various countries throughout the world. The bibliography cited is classed under starch and sugar plants, tobacco, spices, medicinal plants, plants yielding beverages, oils and textiles, rubber, vegetables, fruits, forage crops, green manures and cover crops.

SMITH, K. M. 632.8
Recent advances in the study of plant viruses.
J. & A. Churchill, London, 1933: 15*s.* 0*d.* Pp. xii + 423. 67 illus.

Although the first record of a virus disease dates from 1892, most of the work on the subject has been done during the last 10–15 years when the economic importance of these diseases, which now number over one hundred, came to be recognized.

The present work makes no claim to be a text book but its comprehensive and critical review of every aspect of the subject make it indispensable to every worker on virus diseases.

Although the book is fundamentally a study of plant viruses, comparisons with the work done on animal viruses add considerably to its value. From the point of view of the plant breeder it is interesting to note that the best means for combating the disease is by the production

of resistant types — a task rendered more difficult by the fact that already different strains of the same disease have been observed.
Differences in degree of susceptibility have been observed in a number of plants but the nature of resistance and its possible inheritance are problems still awaiting solution.

PERCIVAL, J. 633.11(42+41)
Wheat in Great Britain.
Published by the author, Leighton, Shinfield, Reading, Berks. 1934: 10*s.* 6*d.*
63 illus.
History, cultivation, classification, description and brief notes on methods of breeding.

SPRECHER VON BERNEGG, A. 633.74 633.76
Tropische und subtropische Weltwirtschaftspflanzen. III. Teil. Genusspflanzen. Band I. Kakao und Kola. (**Tropical and subtropical economic plants of the world. Part III. Stimulants. Vol. I. Cacao and kola.**)
Ferdinand Enke, Stuttgart, 1934: Unbound RM. 18.70, bound RM. 21.
Pp. xi + 264. 48 illus.
The third part of this notable work (see " Plant Breeding Abstracts," Vol. III, p. 155) is to consist of three volumes, the first of which, under the above title, has just appeared. The whole of the first 213 pages are devoted to cacao and only the remaining 44 to kola, which probably corresponds more or less to the relative importance of the two crops.
The treatment is similar to that of the two previous parts. A useful feature in the treatment of the varieties of cacao is the provision of descriptions and a table to distinguish the Criollo from the Forastero types. The sections on breeding are very brief, consisting of a short review of the lines on which improvement can and has been effected.
The presentation and style are as attractive as in the earlier parts and the present volume is even more valuable in being vastly more up-to-date. Each half is furnished with a selected bibliography. The author has done a service to tropical agriculturists in bringing together the information on these two crops, the need for which had been especially felt in the case of the second, to which no work of this nature has hitherto been dedicated.

PARKER, H. H. 633.79
The hop industry.
P. S. King & Son, Ltd., London, 1934: 15*s.* Pp. ix + 327. Illus.
The book begins with a historical review of the hop industry from the introduction of the hop into England in the sixteenth century up to the present day. Under the modern aspects of the industry the breeding of new varieties is given an important place and the results of breeding work at Wye are briefly summarized, giving the various directions in which improvement has been aimed at and attained, such as disease resistance, yield, aroma and preservative properties. The hop industry in other countries is also considered at some length and the remaining third of the book is devoted to marketing schemes.

SHOEMAKER, J. S. 634.7
Small-fruit culture. A text for instruction and reference work and a guide for field practice.
P. Blakiston's Son & Co., Inc., Philadelphia, 1934: $3.50. Pp. xv + 434.
52 illus.
In the work under review an attempt has been made " to include a brief, yet adequate discussion of the cultural practices for all small fruits of commercial importance," grapes, strawberries, bramble fruits, currants, gooseberries, blueberries and cranberries all receiving attention. The areas of cultivation, varieties and their origin, the methods of propagation and best cultural practice are discussed, where necessary by reference to recent research on the subject.

NEW JOURNALS.

" The Cane Growers' Quarterly Bulletin," of which the first number appeared on July 1st, 1933, is published by the Bureau of Sugar Experiment Stations, Brisbane, Queensland. Its object is to present in popular language, and in a form suitable for the cane growers, the results of research work done by the Bureau, on which several thousand pounds are spent annually. The choice of topics is catholic, the first number containing articles on diseases and pests, new implements, irrigation, manuring and ripening of cane, and the third number, January 1934, consists largely of a report of the Experiment Stations for the season 1933.

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